AMERICAN MACHINIST

JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 13, No. 10. WEEKLY. | NEW YORK, THURSDAY, MARCH 6, 1890. | $2.50 per Annum. SINGLE COPIES 5 CENTS.

COPYRIGHT 1890, BY AMERICAN MACHINIST PUBLISHING COMPANY.

For Sale Everywhere by Newsdealers.

ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

A New Compound Engine.

The illustrations on this page and on page 2 represent an engine and a few of its details, built for the California Electric Light Co., of San Francisco, by William Tod & Co., of Youngstown, O., and designed by Mr. C. Seymour Dutton.

As will be seen, the engine is a tandem compound with the Porter type of bed. The low-pressure cylinder is attached directly to the bed, which is the same as that used for their 700 horse-power single Porter-Hamilton engine. The high-pressure cylinder is 20″ diameter, low-pressure cylinder 36″ diameter, and 36″ stroke. The connection between the cylinders is made by a single casting, bolted to the foundation, and of such shape as to allow the piston rod and piston head to be backed out for the purpose of examining the heads and cylinders, and renewing packing rings with the least possible amount of labor. The steam valves are of the Allen double opening type, shown in section, Fig. 1, page 2, the steam chest cover taking the place of a balance plate. The steam, however, is admitted at the center, and cut off by the inside edge of the valve and exhausted at the ends.

The low-pressure valve is actuated by a fixed eccentric, cutting off at a little less than half stroke. The high-pressure valve is operated by the shaft governor shown in Fig. 2. In this governor the position of the eccentric is maintained by a block connected to the governor weights, and sliding in a curved guide, in such a manner as to effectually lock it against the thrust or pull of the valve rod. The drop hook for disconnecting the valve motion, shown in Fig. 3, is worthy of notice, as the eccentric rod does not have to be lifted, the disconnection being made by throwing out a latch.

The manner of attaching the surface condenser and air pump is shown in Figs. 4 and 5. The condenser was designed and built by Fred. M. Wheeler, of New York City. The air and circulating pump is a Knowles independent pump, with 12″ steam cylinder, 14″ air cylinder, and 16″ water cylinder, 16″ stroke.

Fig. 6 is a reproduction, full size, of the indicator cards taken from the high-pressure cylinder; and Fig. 7 are those taken from the low-pressure cylinder. Steam pressure, 100 pounds; revolutions per minute, 142; receiver pressure, 17 pounds; vacuum, 24″. Total indicated horse-power, 701.

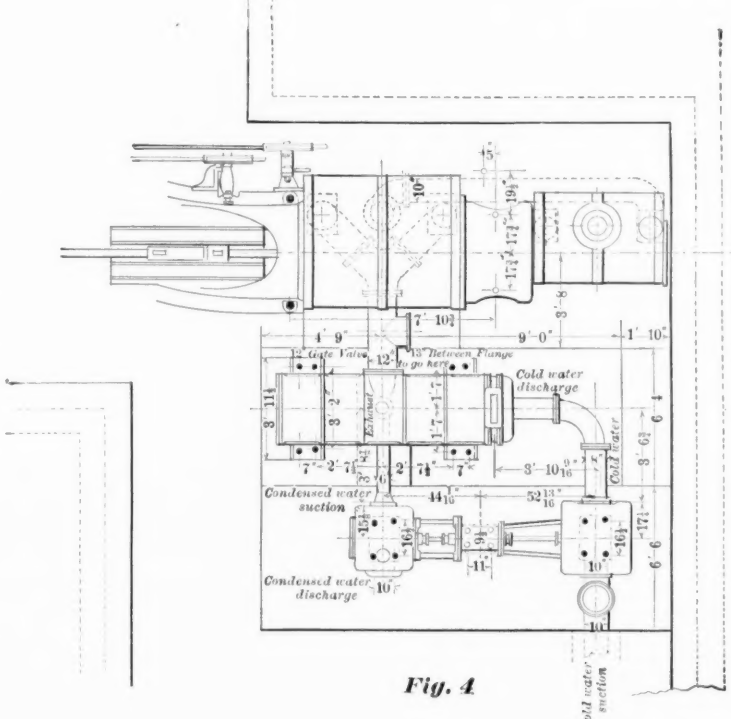


Fig. 4

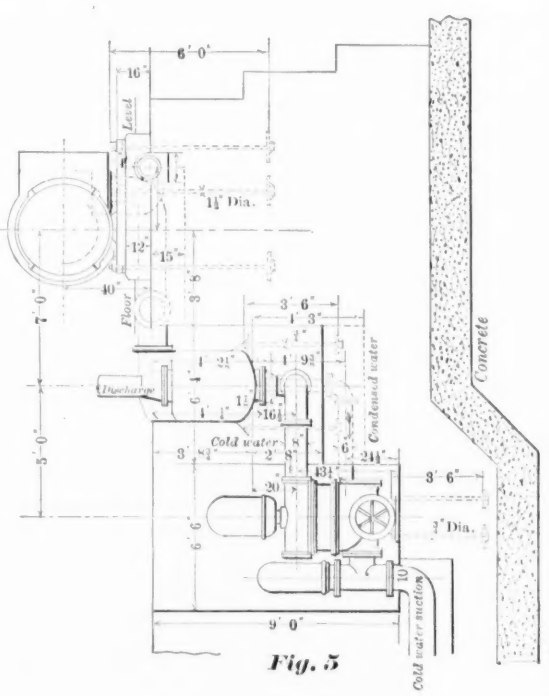
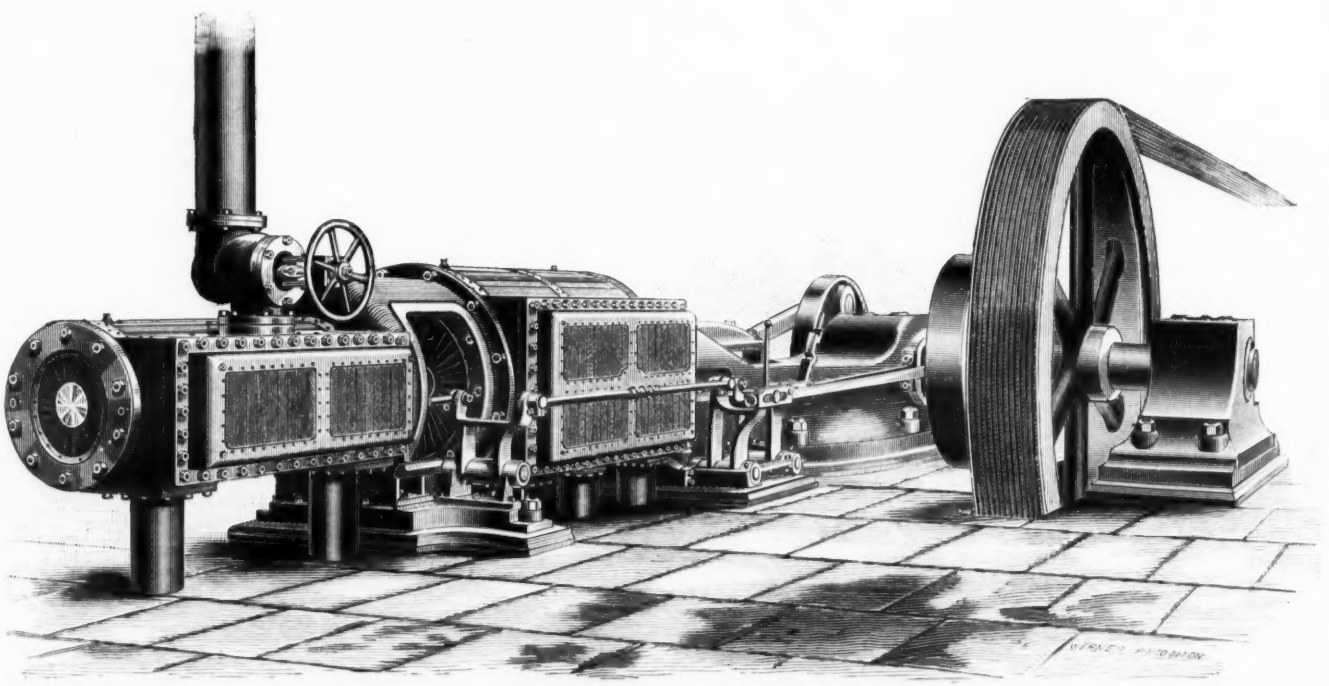


Fig. 5



A NEW COMPOUND ENGINE.

We must, in this world, learn a good deal from the experiences of others. It will be a mighty small world that a man is introduced to by his own experience.

The Speed of Grindstones.

Since the discussion of the comparative merits of grindstones and emery wheels was started by Prof. Sweet's letter, in our issue of January 9, we have received a number of inquiries regarding the proper speed at which to run grindstones. We published one of these inquiries last week, coming from a man who is running a number of grindstones at a speed of 3,000 feet per minute, and never having had an accident, he doesn't know but what they might be run faster, and still be within the limits of safety.

Several have inquired about the most economical speed, under the impression, probably, that there might be a speed below the highest safe speed that would be most economical, all things considered. It is not probable that there is any other limit, however, except that imposed by the ability of the wheel to hold together; or, in other words, it probably pays to drive a grindstone up to the highest speed at which it will be safe.

What this speed is, then, becomes the practical question. With a view to finding out the practice where grinding operations are extensively carried on, we addressed inquiries to Mr. Charles A. Bauer, and to Prof. John E. Sweet, both of whom have in the past been at the head of large manufactories in which there were extensive departments devoted exclusively to work by grindstones.

From Prof. Sweet's letter we make the following extracts:

"I really do not know much about the speed of stones, or what they will stand. In fact, they must vary greatly on account of quality of stone. And I have an impression that the surface velocity of a larger stone can be greater than that of a small one—which differs from the rim of a fly-wheel, because of its being a disk.

"Our Mr. Armstrong says the thing to do is to put a heavy wrought-iron guard over them, and then run them up to the point where they will burst once in a while in order to get the greatest economy. At the Whitman & Barnes Mfg. Co. [Syracuse, N. Y.] they run the 6 ft. stones for the edgers, where they use a mechanical holder for the work, about 2,800 ft. per minute, and the 6 ft. stones for hand grinding, about 4,000 ft. per minute. We run our 2½″ x 18″ stone 700 revolutions, or say 3,000 ft. per minute, though I am satisfied it could be run much faster with safety."

Mr. Bauer's letter is as follows:

"For Ohio grindstones a surface velocity of from 2,000 to 2,500 feet is the limit of safety. For Lake Huron stones, from 2,800 to 3,500 feet per minute.

"My formula for speed of grindstones is thus: d = diameter of stone in inches.

"For Ohio stones:

$$\frac{10{,}000}{d+6''} = \text{revolutions per minute.}$$

"For Lake Huron stones:

$$\frac{14{,}000}{d+6''} = \text{revolutions per minute.}$$

"The best and most economical speed of grindstones no doubt depends on the quality of the stone. A large stone can be run at a slightly greater surface velocity than a smaller one."

It is apparent from the above that there is considerable of what might be called personal equation in the matter. Prof. Sweet runs his 18" stone at a speed of 3,297 feet per minute, and believes it could be run faster with safety.

Mr. Bauer's formulas would reduce its speed, if it is a Lake Huron stone, from its present rate of 700 revolutions to 583 revolutions, or, if an Ohio stone, to 416 revolutions. It seems to be mainly a question of how close one dares go to the extreme limit. It will be noticed that Mr. Bauer's formulas give a somewhat slower surface speed for small stones than for large ones, because there is the constant factor of 6" in the divisor.

By his formula for Lake Huron stones, for instance, a stone 12" diameter would run at a speed of 778 revolutions, which would give it a speed of 2,444 feet per minute, while a 6-foot stone by the same formula would run at 179 revolutions, which would be at a surface speed of 3,372 feet per minute.

The following is self-explanatory:

"I notice a misprint in the article on The American Patent System in your issue of Feb. 20. The last sentence of the third paragraph, last column, page 5, now reads, 'The original patent is surrendered to the Commissioner of Patents when the reisssue is canceled, and then ceases to exist.' It should read, 'The original patent is surrendered to the Commissioner of Patents when the reissue is *granted;* is canceled and then ceases to exist.'

"It is of course the original patent which is canceled and ceases to exist when the reissue is granted. In the eighth paragraph, same page and column, the word 'those,' in the last line but one, should be 'there.'"

D. Walter Brown.

Something About Steel.

By S. W. Goodyear.

Have you space for more talk about steel? Do you know of any other subject which calls forth so much talk, and upon which those who talk differ so much? That there should be such variety of opinion, or lack of downright knowledge, in the matter of adaptability to and value for particular uses of certain steels, is inexplicable; at least it appears to steel consumers to be so.

It is probably a fact that, among the old standard imported steels, some of them with high-sounding names, and at prices twice or three times as great as will in these days purchase a really good American steel, there is not one which is not daily denounced as worthless by hundreds of steel users, who have tried over and over to reach the good results promised by the vendor, and which some of their neighbors, mayhap at their very elbows in the same shops, claim to have fully realized. "Would not take it as a gift. The poorest steel I know of in the market."

To what steel does this apply? Here is a chance to benefit the readers of the American Machinist by steering them clear of such worthless stuff. But there is a difficulty. It applies to every steel known to the trade, both imported and domestic. To illustrate: Of certain steels, both American and foreign made, I have heard said, "We use ——'s steel, because it machines so nice and soft; never have any trouble with it; have tried other steels, and never found any which we could afford to use, if it were given to us. Of course we believe there are other steels, which, when ready for hardening and tempering, would be as good, would have as great ultimate value when ready to go to our customers, but we can't afford to make them into our goods." Seems conclusive, don't it? Whose steel was it? Wait a bit. On the same day, I heard another man say of this self-same steel, "We can't use it for our work, because it is so hard to machine. It hardens and tempers all right, and makes good tools when done; but we have never been able to anneal it soft enough for our use. There is a great deal of milling and turning to do, and it is necessary to have a soft, nice working steel. We use ——'s steel, which always works just right." To get at the true inwardness of this testimony, let me say that the steel used and spoken so highly of by this last witness was one of the very steels which the first man had alluded to as worthless. "Could not afford to use it if given to us."

"Oh, yes, of course, different uses require different steel," do I hear said? But in this case the uses were identical. These two concerns, using steel by the ton, by the car-load, in goods of the same character, for market, and sold side by side for the same uses, both with first-class reputation, testified to exactly what I have written. Do I hear it said, "Yes, that's just a fair sample of the lack of uniformity and general unreliability of American steel? These two men may have believed they were using the same, as they were, so far as brand was concerned; but the steel might vary as much as their testimony shows." My friends, you who see no good in any but imported steel, let me rejoice your hearts by recording the fact that the first mentioned steel was one of the most popular of the imported varieties. Both men drew their supply of that particular steel from the same stock. Of course you will say that it was the fault of the man who condemned it, that he did not succeed as well with it as his neighbor; that it was a question of treatment. Admitted; but tell me please, why the same rule will not apply in the case of the other steel, which was of a well-known American brand?

With proper treatment *it* had for years given entire satisfaction, had proven to be as uniform as had the old reliable English brand in the hands of its user and advocate. Both are good steels; can anybody explain why both of these two men do not succeed in using one as successfully as the other? Is it not clear that they might do so?

One of the extremely knotty questions to answer is, how it can be possible for certain steel users to hold to their expressed belief that for special uses, which involve combined hardness and tenacity in marked degree, or for which extreme durability in cutting tools is required, nothing will do except one of the high priced imported steels, costing from three to four times as much as "best cast-steel" of American make, when their neighbors are, with these same home-made steels, doing identically the same work, doing it just as well, and just as much of it. What do they say about it? "Oh, well, *they may* be able to do *their* work with *such steel*, *we* could do *nothing* with it on *our work*."

What am I driving at? Just this. If a certain steel, or any number of them, by actual service, treated in such ordinary commercial manner as may be conveniently adopted, should prove a success in the hands of any one man, the fact must stand thoroughly demonstrated, that another man, or any number of men, *can* use the same steel as successfully. It cannot be a question of *who* treats it, but of *how it is treated*, and just so long as the method is adopted, which is described so accurately by a large consumer of steel, below, shall we have the same condition of affairs in the matter of adoption or rejection of steels. Said the manufacturer referred to: "We have our regular methods for heating steel for hardening. We *know* what is the proper heat, and *any* steel which either fails to harden properly or cracks in hardening at *our* heat, we don't want anything to do with." That fifteen minutes time spent in experimenting with a steel which has been condemned as worthless by this man, and perhaps a variation of 75 to 100 degrees in the hardening heat might give him a product equally as valuable, or even fifty per cent. more valuable than his old favorite, standard steel, would have no effect. Given a case in which a die or tool of any sort is known to have been made of any but the accepted standard, and fails to come fully up to the maximum service,

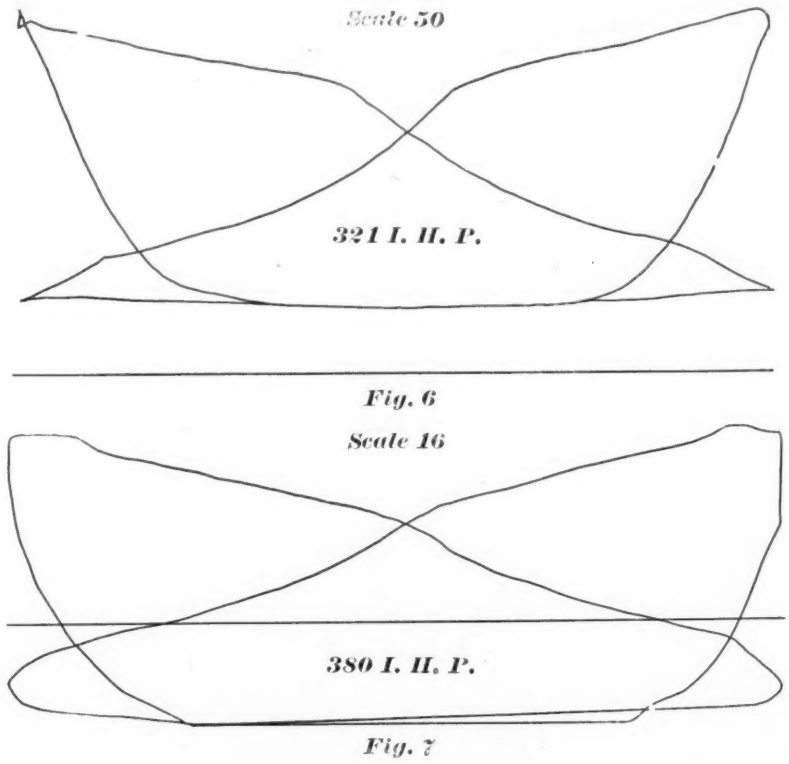


Fig. 6

Fig. 7

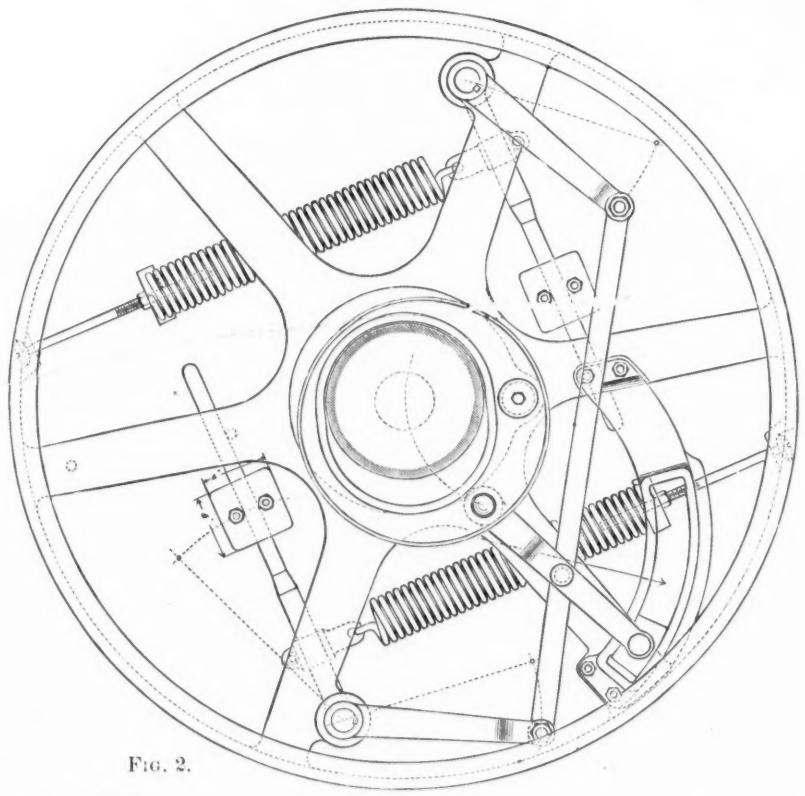


Fig. 2.

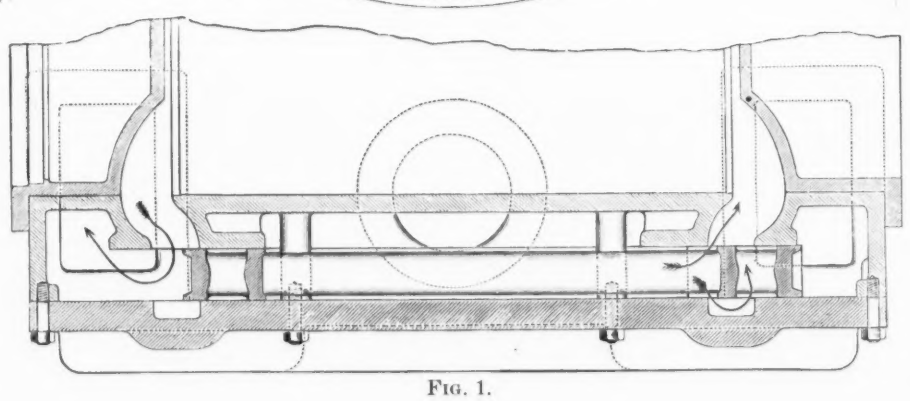
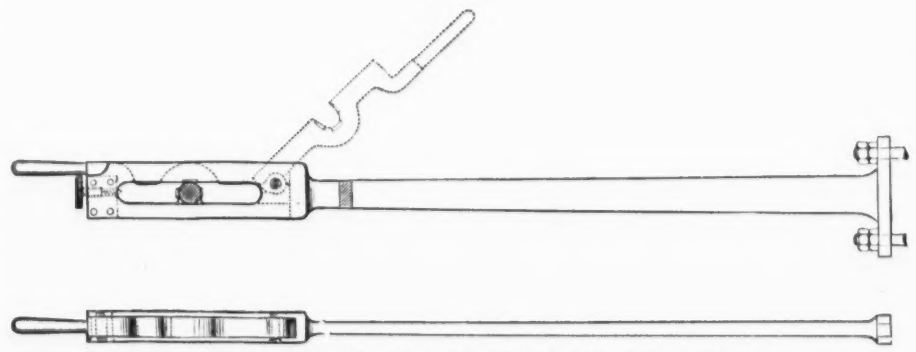


Fig. 1.



A New Compound Engine. Fig. 3.—(See Page 1).

and how quickly it will be laid to the steel. Still there are inferior bars of steel of the best brands, and, inferior tools are made from the best bars. Why not then be fair about it, and accord to the newly tried steel the benefit of the doubt, as you are so ready to do in the case of an old favorite brand, instead of assuming at once that "it's the fault of the steel"?

Does it ever occur, I wonder, to those who so strongly assert that no American steel has been made, aye, more, that none will ever be made to compare with the old reliable English brands, or to that other equally misguided class of steel users, who assume to believe that no steel is now made, either foreign or domestic, which comes anywhere near being as good as the old imported steels, which we used, say from thirty to fifty years ago—that there are all about us the strongest kind of evidence that the exact opposite is the fact? Tools are asked to do, and are doing daily, in thousands of places, what would have been considered impossible in the days of the much bemoaned "superior steel, which can't be had nowadays," and, in this country, American steel is doing a large majority of this severe work.

For years there has been a continual struggle on the part of the builders of machine tools to add to their ability to do more work in a given time.

That heavier beds, stiffer crossheads and spindles, better fitting journals, wider pulleys, etc., etc., have come to be the rule, implies that the tool, the passive agent through which the benefit shall be derived, shall be better than formerly; and it is. Tools are working to-day by the thousands, all through the length and breadth of our country, which, in their capacity for turning out a given amount of work daily, or in their aggregate production during a lifetime service are doubling, trebling, yes, outdoing the old-fashioned tools of our grandsires, of the sires of some of us, tenfold.

Why not? Why should the steel manufacturer be shut out from improvements in his line? What was there about the methods by which steel makers of half a century or a century ago produced the wonderful steels of which we hear so much, which must necessarily have died with them?

Is it not one of the generally accepted as fact beliefs, that, given a need, it is almost sure to be met? In no way has this been more fully verified, than in this very matter of tool steel. By the ton and carloads, steel is finding its way from under the shadows of the Alleghanies, which when made into tools, takes up the struggle to cut, turn, plane, and otherwise mark the harder metals, or metals in harder condition, which modern methods have found it desirable to use, where the old-fashioned "warranted" varieties have been made to do their best and have failed, and these home-made steels, of which every American should feel proud, are going along

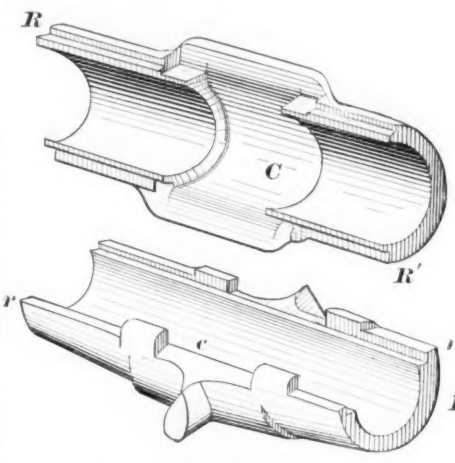


Fig. 1

Fig. 2

Shop Notes.

BY JARNO.

No. 18.

BOXES BORED WITH A MILLING CUTTER.

Mr. McGregor noticed that it took much time and many files to fit the two parts of the hanger-shaft boxes together before boring. They were made in an old way, being fitted with a file at the rabbets *R R'* and *r r'*, Figs. 1 and 2, and then kept in pairs through every subsequent operation. They are of the self-oiling variety; a wick comes up from an oil well, and in going through the chamber *C* in the upper half of the box, Fig. 1, it rests upon the shaft. In order to make it easy to bore these boxes, there was a chamber at *C* in the lower half, Fig. 2, opposite the one in the upper half. After boring, the chamber in the lower half was filled with babbitt-metal.

only as they are wanted to put into hangers. Boxes were thus milled years ago in Philadelphia.

These are some of the items of saving:

Files, and the time of fitting.

Babbitt metal, and the time of babbitting.

Difference between milling and boring, milling being less in time and cost.

Inconvenience and room to keep the boxes assembled in pairs before they are put in the hangers.

All the items amount to about one-half of the old cost.

When any one makes a suggestion to Waubug Mephit, the first thing that he says is, "That will not work." But Mr. McGregor sometimes forms a syndicate of the suggestions of others in connection with his own ideas, and thereby increases production. It is to be hoped that machinists will not form syndicates to reduce production.

54-Inch Lathe for Gun Work.

We present, herewith, illustrations made from the working drawings of a lathe designed by Detrick & Harvey, of Baltimore, Md., for the use of the Navy Department, in turning and boring the steel hoops for 6-inch rifles; five of the lathes having been built by the above named firm, for the new gun factory at Washington.

A distinctive feature in the design, it will be noted, is the Albro-Hindley worm wheel, which is the main driver, and has been substituted for the ordinary spur gearing, as it was thought to be better adapted for the work for which these tools were intended. All the threads of the worm having a full bearing on an equal number of teeth on this wheel, a very smooth and uniform driving motion is secured. The worm running in oil gives perfect lubrication, and, with the wheel, is entirely protected from dirt. The bed is of a double-web section, 1" thick-

and upon this worm shaft are two spur wheels of different diameters running loose on the shaft, which are engaged or disengaged by a square-toothed clutch sliding on the shaft. The cone, which has five changes for a 4" belt, gives, in connection with the gearing, 10 changes of speed in ratios from 20 to 1 to 120 to 1.

The tail stock has 42" bearing on the bed, is gibbed down for use in boring, and has four bolts for clamping it to the bed, which operate independently of the gibs. A removable cap enables the sleeve to be replaced by a boring bar. It has hand movement along the bed, and a power movement, and feed in either direction for boring, by means of a splined rod, the rack and train of cut gearing.

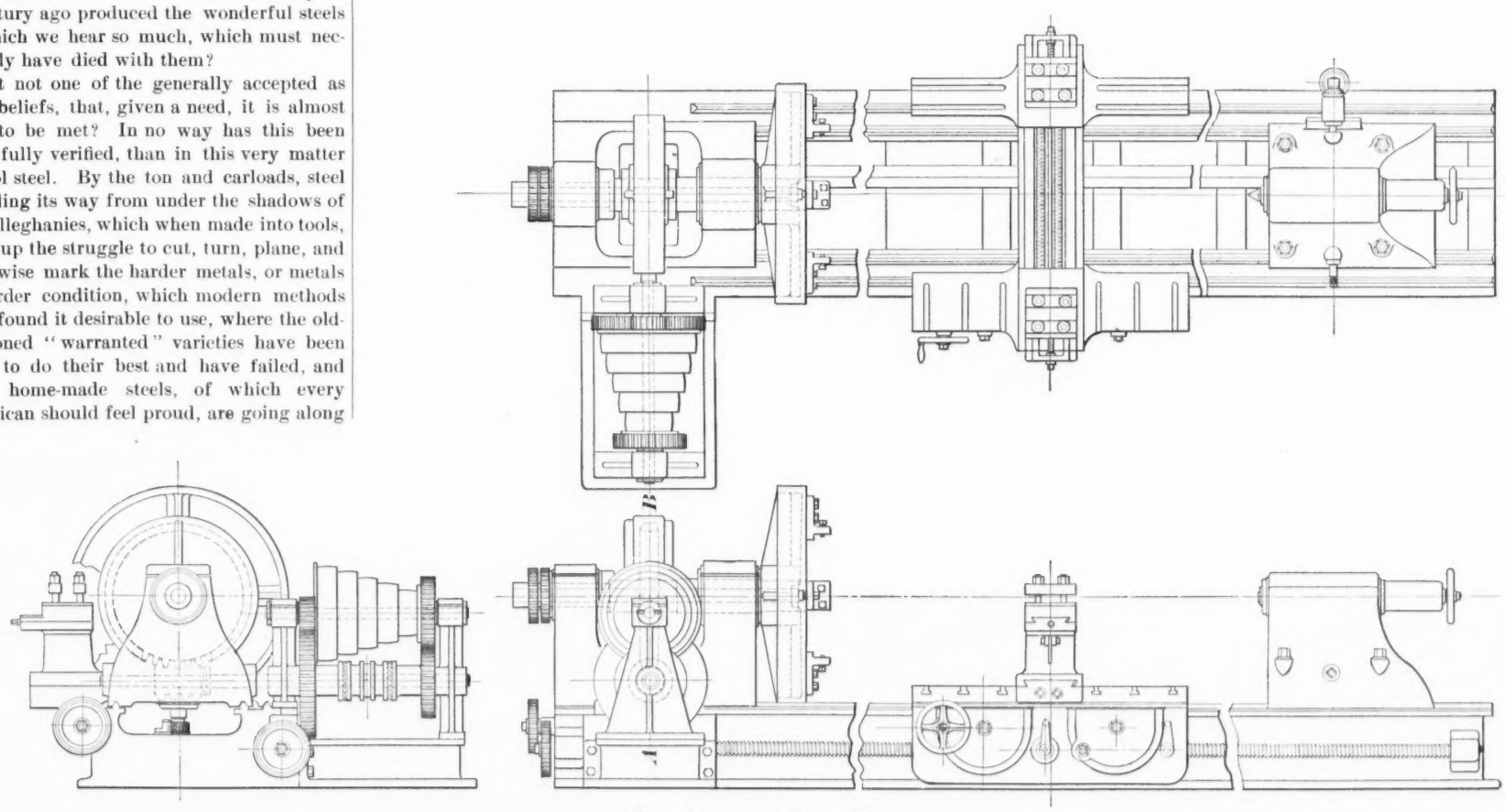
The carriage is fitted with two cross-slides, which can be fed automatically in either direction. Both are compound rests, adapted to turn a full circle, and have each a 12" hand movement. These cross-slides can be fed simultaneously or separately in either direction. The carriage has a bearing on the bed 5 feet long, and is gibbed down both front and back. The cross-slide is 14" wide, with a cross-section of 10" deep.

Lathe swings 54" over the ways, 36" over the carriage, and weighs about 29,000 pounds.

They have proven in use to be very efficient tools for the work they are designed for.

In Paris, whenever a local shopkeeper advertises to sell "at cost," a government official, detailed for the purpose, swoops down upon him, and makes a careful inspection, in order to satisfy himself that the merchant carries out what he advertises. If the latter is detected in fraud, an adequate punishment is at once meted out to him. They don't deny a man's right to sell his goods at less than cost if he chooses, but he must not publish any lying advertisement. — *Canadian Journal of Fabrics.*

A Berlin correspondent of the *Standard* says he is informed that the rumors of an



54-INCH LATHE FOR GUN WORK.

without a murmur, cutting over square feet of surface, inches of which would call for grinding, if standard old-fashioned "warranted" steels were used.

There are those who ask for soft stock to turn or otherwise work, well annealed. But there are others who ask for stock "as hard as it can be cut." Cast-steel castings are taking the place of cast or wrought-iron. Large masses of steel, which it would be desirable to harden, but, from their size or shape, cannot be hardened safely, are

Mr. McGregor thought that he would leave more stock on the rabbets, and then fit together by milling. He asked a shop-mate whether it would be practical to do this. The shop-mate at once asked whether he meant to mill the places for shaft bearings. The reply was, "I did not, but I do now." The change has been made, and the saving in time and files is greater than was expected. The rabbets and shaft bearings are milled at one operation. The boxes are now assembled, reamed, and one end squared up

ness of metal, 19" high under each of the double Vs. Cross-girts are also of the double-web section, and are placed about every two feet in the bed. A rack is fitted on the front flange of bed outside for a hand movement and feed of carriage, and one inside for a hand movement and automatic feed of tail stock, when used for boring.

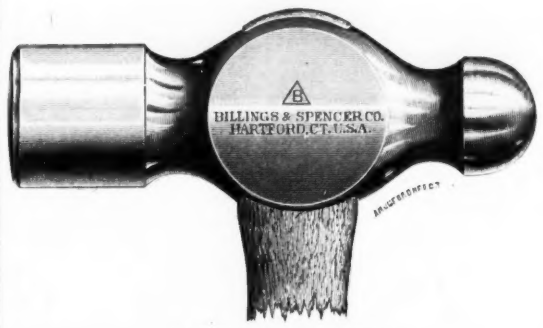
The spindle of forged steel is 7" in diameter, and has a 3" hole running through the center. Under the spindle, and at right angles to it, is located the steel worm shaft,

early construction of railways in China are unfounded, and that the project of laying down lines in Manchuria has been abandoned. The Chinese Government has had to give up all its great railway plans because public opinion in the country is strongly hostile. Russia, on the other hand, is quietly strengthening her army on the Chinese frontier, and has just ordered the reinforcement in December of the two East Siberian Rifle Brigades by one battalion each.

Machinists' Hammers.

There are few tools about which a machinist is more particular than about his hammers. He usually has a decided antipathy to "store" or manufactured hammers, for the reason that little or no attention is usually paid in the making of such hammers to the points about which the machinist is most particular. The hammer itself is usually a clumsy, misshapen thing, provided with a handle in which there is no elasticity, and which never seems to have the right "hang."

We give with this an illustration of a hammer made for machinists by a member of the craft, and in which pains have been taken to produce a superior article, to meet the objections found in the average "store" hammer. They are drop-forged from the best tool steel, and are carefully tempered and finished in a thorough manner. Particular attention has been given to the handles in regard to shape, elasticity, and "hang," and it is believed that a hammer has been produced which will prove acceptable to most machinists. They are made in four sizes, weighing respectively ¼, ½, 1¼ and 1½ pounds, by The Billings & Spencer Co., Hartford, Conn.



Machinists' Hammer.

Practical Details of Blacksmithing.

By B. F. Spalding.

TWIST DRILLS FOR LONG HOLES—FORGING SMALL TWIST DRILLS BY HAND—FULLERING OUT LARGER SIZES—TWISTING THE BLANKS—TURNING AND FINISHING—SENSITIVENESS TO CHANGE IN SIZE—MILLING OUT STRAIGHT LIP DRILLS.

It is sometimes very desirable to use a twist drill for some purpose, when it so happens that there is none at hand which will answer. The shanks are not of the right size or shape, the drills themselves may be all too large or too small, or the length of the drill required may be such as the manufacturers do not keep in stock, and one cannot be obtained from them without considerable delay. Those in common use are now so easy to be procured of the makers, and can be had of such excellent quality, that the necessity of using home made twist drills is of but rare occurrence. It is, nevertheless, very convenient to have the means to meet any emergency which may arise, and the art of making twist drills by hand should not be forgotten.

Before the days when twist drills became an article of special manufacture, by parties who milled them with revolving cutters out from the solid stock, their good qualities were well known and thoroughly appreciated in the gun business, and some of the old-time drillers could make small drills for their own use, which, in their hands, would do as much work as any that are now made by machinery; indeed, for some time it was, as in file cutting, a mooted point whether the machine could outdo hand-work; it was claimed that those which were forged out had a chance to have the center refined by the hammering, while those which were milled out did not; this was got over by the manufacturers by the simple expedient of using steel that was so good that it needed no further refining. Some makers failed to discover this trade secret, and in so doing were very unfortunate.

The old drillers, who made their drills by hand, shaped them in different forms, as the exigencies of their work required; some were quite thick on the edges and thin in the centers, with the long twist, which this shape made necessary in order to leave sufficient groove to afford free passage for the chips, while some were but little thicker on the edge than in the center, and these could be made with a shorter twist, and thus present a more acute cutting edge to the work, giving less of a scraping cut, and removing the chips with greater facility. The drills used in drilling out solid decarbonized steel gun barrels were of the latter description, the depth of the holes for which they were used making a free cut and good clearance—matters of prime importance. There was but little difficulty in grinding. It was essential that the sizes should be kept so that a long drill would follow a short one as the depth of the holes increased, and that they should not bore holes too large to be cleaned out by the subsequent reaming. They were forged flat and quite thin, a little wider than the gauge, then twisted and hammered around on the sides to bring them to fit the gauge. They resembled wood augers more than the usual form of twist drills.

The smaller drills, for drilling the limb work, were forged flat, and as thin as the centers of the drills required to be made, and a third, sometimes a half as wide again at the point as their diameters were to be when finished, increasing in thickness and diminishing in width as they receded from the point. They were then twisted with a gain twist, the twist being closer at the point than it was back, and were then hammered around on the sides with a hammer which was light enough to upset the edges evenly without crippling the center. By dint of striking them a good many light blows, excellent drills were made in this manner, having the edges of uniform thickness throughout their length. The fluting appeared to be of uniform width, although its depth increased, and the thickness of the center decreased as it approached the point. They were sometimes run through a hollow mill, before hardening, to bring them accurately to the required size, and, after very little filing in the flutes, were hardened and tempered with all the skill and care that would naturally be exercised by men who knew that the amount of wages they earned depended upon the excellence of their staying qualities.

For some years before the civil war broke out, most of the drills used on gunwork were twist drills. Their use was an important element in the system of making the component parts of guns interchangeable, which was inaugurated at the U. S. armory, in Springfield, in 1840. The drill jigs at that time were made with as much precision and skill, and were as well designed as any that are made now. The fact was not then newly discovered, that flat drills would not guide well in drilling through bushings, for drilling jigs had then been in use for some thirty years. Some of the larger holes were made with turned drills, with straight flutes on two sides, thin in the center, technically termed pod drills.

Later than this, drills larger than three-eighths were made by fluting them out with fullers, before twisting. The fullers used for this purpose should be about nine-eighths of the size of the drill. The top fuller should have the eye punched so that the handle will stand at right angles with the blade, instead of on a line with it, as in fullers used for general work, and the bottom fuller should stand across, instead of lengthwise of the anvil. The ends should be rounded off, for the purpose of leaving the back ends of the flutes smooth, and also to throw the stock forward out of the center on the rolling principle (see Fig. 1). The stock is first drawn down, round, to the size the drill is intended to be, and then flattened enough on opposite sides to give a good mark by which to place the fullers. The flute is then put in so that the stock is evenly divided. This is a very particular part of the operation—Fig. 2 shows the effects of setting the fullers a little out of the center—and no amount of skill can make a good drill of one which is defective in this respect. The same general principles are observed in making the large drills which have been mentioned as having been adopted in forging the smaller ones. The center is left thinner, and the stock wider at the point before twisting (see Fig. 3.)

The twisting may be readily done with tongs and the vise. It is necessary to bring up the edges of the flutes very nearly to sharp corners, as it is not desirable to have much superfluous stock left on the drills to be turned off in finishing them to size, and for this reason some caution must be exercised to avoid mutilating the edges, otherwise nicks will be left in them which will require much filing to remove. The flutes must be left quite open (see Fig. 4), as they will close by hammering. After twisting it is better to hammer them down very close to the right diameter on the anvil with a light hammer; for the blacksmith can guide the stock with his hammer in whatever direction he chooses; but if he puts on his swages the movement of the stock is not so completely under his control; the sledge blow is so ponderous that its action is felt entirely through the drill, thickening it up through the center, or cramping it, so that the flutes on one side will be wide and shallow, and those on the other will be deep and narrow; the stock, which should be in the center, will be on the side of the shallow flute (see Fig. 5, showing this cross-section). This can all be avoided by the skillful use of the hammer, and the use of the swages is restricted to a very little smoothing around, which may be done by striking a few blows on them with a light backing hammer.

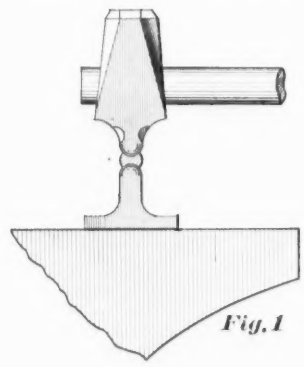


Fig. 1

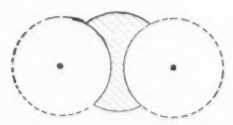


Fig. 2

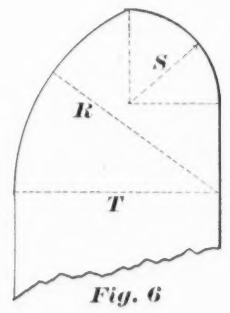


Fig. 6

Fig. 3

Fig. 4

Fig. 5

In twisting the fluted blanks for the drills, they shorten in length and enlarge in size. The pressure used in drilling with a twist drill tends to shorten it, which increases its size, while the resistance offered by the material to the lips tends to straighten the forward face of the flute, and this tendency, resisted by the back, also has its effect in expanding the size of the drill when in operation. This strain, tending to untwist the drill, opposes the downward pressure, and, in a measure, the stresses of the couple counteract upon each other. The downward or end pressure keeps the drill from untwisting, and the untwisting strain from the cut keeps the drill from shortening, and thus taking a shorter twist; the balance, however, inclined perhaps by some circumstance of irregular grinding of the lips, generally tips to making the hole larger than the drill.

For the purpose of having twist drills as stiff as possible, the edges are made as wide as is compatible with the free egress of the cuttings, because, as the centers must be thin, certainly at the point, to enable them to be pressed into the work, and this thinness must extend back to some distance to allow for wearing up, the strength of the drill depends, in a large measure, upon the amount of material in the edges. After the forging is completed the points are cut off straight with a thin chisel and hardy. They are then annealed by being heated to a dull red heat and placed in a box of fine charcoal, in which they are allowed to cool. They are finished by turning in a lathe on centers. A short tit is turned on the point back as far as the center hole extends, and the outline of the point is laid out by the lathe to form a guide to file to, after which, the flutes are smoothed out, and the center of the point thinned down as far back as desired by filing. They are then ready for hardening.

If the end pressure, required to force a drill into the work in hard metal, is greater in proportion to the resistance offered to the cut than it is in soft metal, then the point of the drill used for soft metal should be thicker than that used for hard. If the center of a twist drill is removed, nothing remains but the two helical springs formed by the sides. If the drill splits through the center the effect is nearly the same; the only part of the material in it which is in a straight line from end to end is that small piece of round cross-section, the diameter of which at any point is equal to the thickness of the center at the same point, and all the rest is curved to spring. Realization of this fact may induce consideration and commendable caution on the part of those who limit the amount of pressure they bring to bear on a dull drill only by the amount of muscular energy they possess.

The causes of the increase in the size of drills in twisting are suggested by attempting to twist a strip of thin material, such as hoop iron or paper, when it will be instantly perceived that, as the edges are deflected from a right line in the process, the inside becomes looser. If this strip be an inch wide, and it is twisted half way around in the longitudinal space of one inch, the inside must be three-tenths of an inch shorter than the edges. It will then be seen—if the experiment be tried with hot iron or a strip of lead—that the outside will stretch a part of this three-tenths of an inch, and the inside will be forced together enough to make up the total. In the case of the fluted drills, the center is weak in proportion to the edges, and the stock in it is therefore drawn together, congested or upset, even more than it would be in a flat piece; and, as there is nothing to prevent its widening out, the accession of stock manifests itself in this manner, and it will be noticed by this illustration how slight an alteration in the twist will make a difference in the size of the drill.

It may be thought that the straight lip twist drill is not subject to the alteration mentioned, for the reason that a radius remains of the same length when drawn to any part of the circle. Even if the straight lip was on a straight surface of flute this objection would hardly apply, but an examination of Fig. 6, which exhibits the shape of cutter used in a milling machine to make the straight lip on a drill, the spiral of which is milled out on an angle of twenty degrees, will show that the flute is in no place flat. The radius of the small curve *S* is three-eighths of the diameter of the drill, and the radius *R* of the large curve is two and one-

fourth times the short radius S, and the thickness of the cutter T is equal to the radius R.

Decimally—

$S = .375$ of the diameter of the drill.
$R = .838$ " " " "
$T = R$

Ventilation by Disk Wheels.

The subject of the proper ventilation of workshops and other buildings, though it has attracted considerable and a constantly increasing interest, almost ever since architecture advanced to the position of a recognized art, is still sadly neglected in some quarters, many people having a very inadequate idea of the importance of an abundant supply of pure and fresh air, and its effect upon the health and efficiency of those breathing it.

While many thousands of dollars have been expended, and numerous devices put to test in the endeavor to secure a perfect system of ventilation, attention until more recently has not been directed to securing a perfect freedom from foul air in the many factories and manufacturing establishments giving employment to a large per cent. of our city population, the work often being such as poisons the air to an alarming degree, telling sooner or later on the health of those who are compelled to breathe it.

In these ventilating experiments which have been made, more especially in the interest of securing a perfect system for large buildings, such as theaters, churches, etc., it has been clearly demonstrated that all methods that depend in a greater or less degree upon natural draught for movement of air, are more or less affected by atmospheric changes, and in consequence a certain amount of air, as being regularly supplied in a given time without reference to outside conditions of the weather, cannot be relied upon, ofttimes such systems being rendered practically dormant by some of these conditions. The general conclusion is that satisfactory and regular ventilation at all times can be secured only by a mechanical movement of the air, by which a given quantity of it is exhausted and replaced in given time, regardless of atmospheric conditions.

The disk wheel has proven to be one of the most efficient means of accomplishing this end, and our illustrations show such a wheel, with methods of application, as made by the Buffalo Forge Co., Buffalo, N. Y. This wheel has been recently improved by the builders, and among their claims for it are ample capacities to handle large volumes of air at small expense of power; perfectly noiseless operation, adapting them to use in a large number of places where noise could not be tolerated; while they are of handy form and light, and are fitted with a self-oiling device which permits the wheel to be left without attention for long periods of time, which is an especially valuable feature when used in cupolas and other places not easy of access.

A disk wheel is very convenient for use in connection with pipe connection for direct work in removing smoke, and gases from forge fires, steam from boiling kettles in steam confectioneries, and the unpleasant odors arising therefrom in dye houses and in other similar locations.

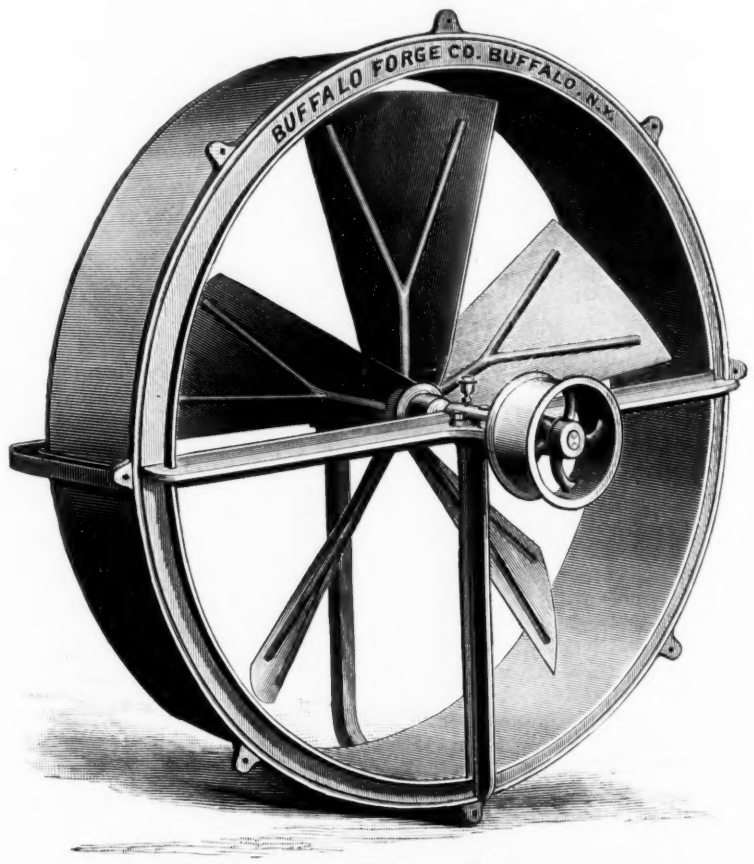
In the application of an exhaust disk wheel where piping is necessary, the wheel is always placed as near the work to be accomplished as possible, with large branch pipes and main pipe of full diameter of wheel. The branch pipes are made with telescopic joints on the different kettles, etc., to admit of raising up out of the way when filling or removing material from kettles.

Smoke, gases or steam can always be more easily and effectively removed by being taken immediately into pipes at the points where they are generated, and conveyed to exhaust wheel, than if permitted to expand into an open space or room, and thence carried off.

In paper or pulp mills a disk wheel will remove the dense volume of steam and vapor from machine rooms, prevent condensation and dripping from the ceiling and roof in winter, and take away the surplus heat in summer, which is so troublesome and injurious to workmen and goods.

It will remove completely the dust from rag machines, and keep the room entirely clear of this in every way. It will keep the engine room and all parts of mill free from injurious gases and corrosive chemical fumes, and remove all offensive odors.

In soap and glue manufactories it is found to be very useful for drying, enabling very uniform results to be obtained, regardless of atmospheric conditions, and at all seasons of the year.



VENTILATING WHEEL.—FIG. 1.

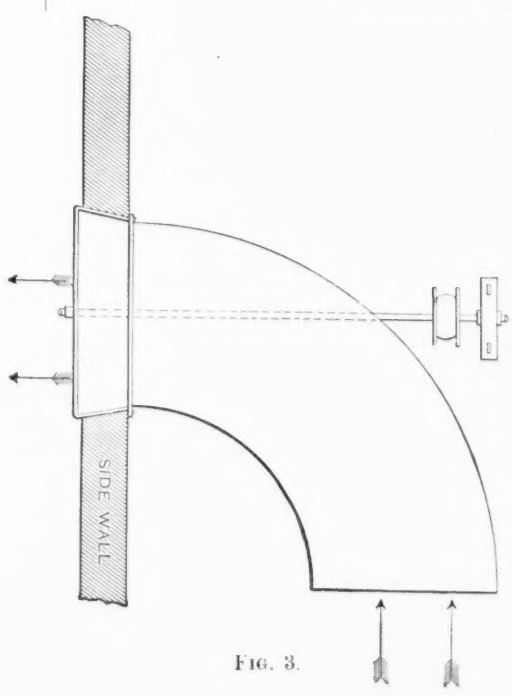


FIG. 3.

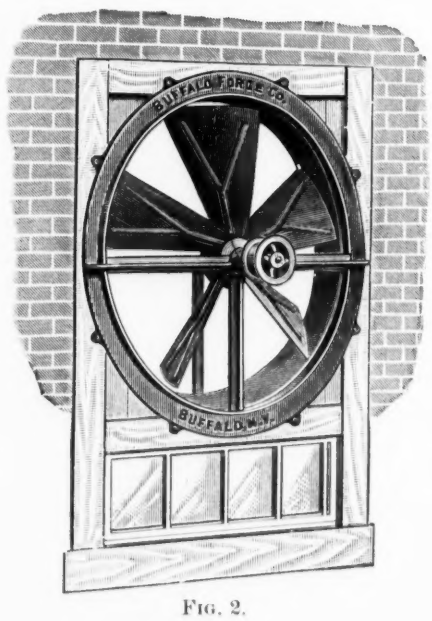


FIG. 2.

For drying wool, tobacco, fruit, hides in tanneries, etc., they are of special value when properly applied, doing the work thoroughly, evenly and rapidly, and may be utilized with much profit.

The general sizes range from 18 inches to 84 inches in diameter, though it is possible to make larger for special requirements, and something of an idea of the amount of air which may be removed by the different sizes at a given velocity may be obtained by noting that a 24-inch wheel at 300 revolutions per minute exhausts 1,864 cubic feet.

Fig. 2 of the illustration shows its application to a window, and Fig. 3 is a sectional view of the arrangement where it is placed in a window or wall, discharging outward.

The American Patent System.

BY D. WALTER BROWN, PH. D.

VI.

THE EFFECT OF PRIOR FOREIGN PATENTS ON THE AMERICAN PATENT.

It often happens that a foreign inventor who has patented his device abroad, afterwards obtains a patent in the United States; and, not seldom, through various circumstances, an American inventor obtains a foreign patent before his American patent is granted.

In all such cases, and without regard to whether the inventor is an American or a foreigner, our law says that:

"No person shall be debarred from obtaining a valid patent here, by reason of that invention's having been before patented in a foreign country, unless the invention has been in public use in the United States for more than two years before the American patent is applied for."

That is to say, the fact that an inventor has patented his invention abroad will not prevent his afterward obtaining a valid patent here, unless, in some way, the invention has come into use here more than two years before the American patent is applied for.

But in these cases of prior foreign patents on the same invention, our statutes limit the duration of the American patent in the following manner:

Every American patent granted for an invention which has been previously patented abroad, expires at the same time as that foreign patent expires; or if there are more than one foreign patent, then the American patent expires at the same time with the foreign patent which has the shortest term to run.

Thus, if, before obtaining an American patent, the inventor had taken out several foreign patents, the American patent would expire with that foreign patent which first expired.

Now, in the interest of justice to the inventor, and of common sense as well, the question has often been asked: Does the American statute mean exactly and literally what it seems to say, that, viz., the American patent shall expire at the same time with the foreign patent, which was granted *before the American patent was granted?* or does it really mean that the American patent shall expire at the same time with the foreign patent, which was granted *before the American patent was applied for?*

The distinction is of great importance; for if the latter meaning were correct, then, if an American inventor applied in good faith for an American patent, before he applied for a foreign patent, that foreign patent could not limit the American patent, no matter whether the foreign patent were actually first granted or not.

This is the view of justice, and of enlightened common sense, but, unfortunately, the words of our law are so precise that the courts have felt obliged to decide that an American patent is limited to expire at the same time with the foreign patent which was first granted, even if the American patent were first applied for.

In practice, the unfortunate result is this: An inventor applies first for an American patent; then he applies for a foreign patent. But by reason of the careful examination made by our Patent Office, and the unavoidable delays in our practice, the foreign patent is first granted. That patent will limit the life of the American patent, although the inventor first applied here for his patent.

Again, in some foreign countries the laws are such that, if an American patent is published in the reports of our Patent Office, or particularly in the full specifications which are regularly issued here, a valid patent in those countries cannot be obtained.

Thus the American inventor is at times between the devil and the deep sea, liable to be devoured here, or drowned there.

The procedure for such cases is the following: Apply first for the American patent, and prosecute it through the Patent Office, until you are notified that the patent is allowed, then decide on some date (a Tuesday) on which the foreign patents are to be entered; pay your United States fee on such a day that the American patent shall issue on the Tuesday decided upon, and arrange with your foreign agent to have the foreign applications entered on that same day, or as soon thereafter as possible. Thus you will, by aid of considerable ingenuity, save both your American and your foreign patent.

Again: In some foreign countries a patentee may either pay the whole fee (a very large sum often) at once, and take out a patent for the full foreign term, or he may pay a certain part only of the fee, and take out a patent for only a part of the full term, with the privilege of extending the patent up to the full term, by subsequent payments of the remaining fees.

Now in such cases it was formerly held by our courts that if, for example, an inventor paid the five year fee and took out a five year foreign patent before he obtained his American patent, and afterward extended his foreign patent to its full term of fifteen years, the American patent should nevertheless live only to the end of the first five years, and then expire.

Fortunately, however, the Supreme Court has recently decided that in every such case,

where the patentee keeps his foreign patent alive to the end of the full foreign term, the United States patent shall also live to the end of that full foreign term, no matter how short a time the first foreign fee was paid for; but provided that the American patent shall never live more than seventeen years.

Once more: In some countries there are various provisions of law requiring the payment of certain stamp duties, or the manufacture of the invention in those countries, e.c. etc.; and the failure to perform any of these requirements will invalidate the foreign patent.

Now, suppose an American inventor has been so unfortunate as to obtain a foreign patent before he got his United States patent, and that by the failure to perform some of the above requirements, the foreign patent speedily lapses. Will that lapse also kill the American patent? The answer is difficult, and depends on the interpretation of the recent decision of the Supreme Court above referred to.

Justice and common sense say, no, and personally I believe that is the correct answer. I do not believe the Supreme Court intended to put an American inventor at the mercy of the foreign purchaser of the foreign patent, who, by neglect or intention, which the American inventor could not control, might destroy the foreign patent and the American patent at the same time.

I do not believe the Supreme Court intended that; I do believe it intended this:

"When an inventor has obtained a foreign patent, and afterward obtains an American patent, that American patent shall live to the end of the full term provided for by that foreign law; and shall not be defeated by any such acts as the payment of only a part of the foreign fees required for the whole foreign term, or by neglect to afterward observe any requirement exclusively restricted to the conditions of that foreign country, but having no recognition in the spirit or the practice of our patent system."

However, this is simply my personal opinion, and opposed to it is the weight of the opinion of American patent lawyers, and the decisions of the Circuit Courts. A wise inventor will therefore act as if the American patent could be destroyed (in case a foreign patent should first issue) by such failure to conform to the various requirements of the foreign law as destroys the foreign patent.

The practical sum of the whole matter is this:

Apply for the United States patent before you apply for the foreign patent. Do not apply for the foreign patent until you receive notice that the American patent is allowed by our Patent Office. Then arrange, as above pointed out, that the foreign patents shall be entered on the same day (or as soon after as possible) that the American patent issues.

A Girl Machinist.

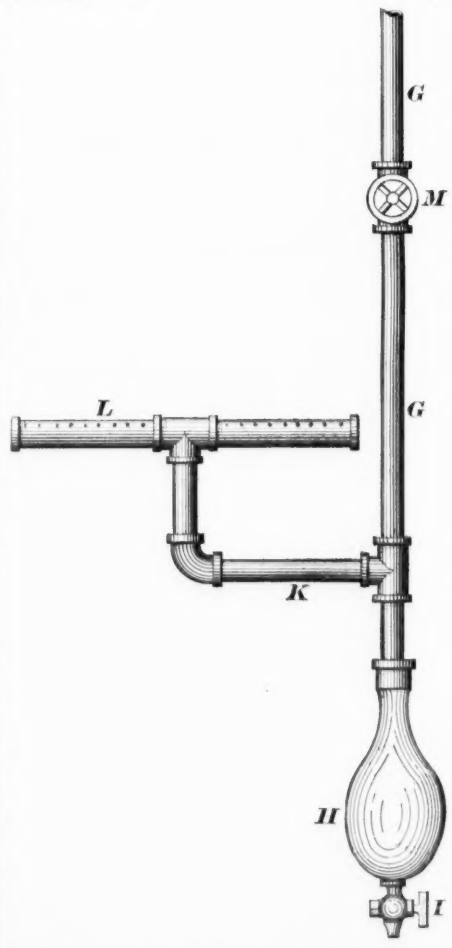
Miss Nellie Patterson, one of the prettiest girls in the village of Mount Carmel, says a Connecticut paper, has just completed a four years' apprenticeship to the machinists' trade. To-day she is working at her lathe and vise in the factory of the Mount Carmel Belt Company, and there isn't a mechanic in the whole shop who can do a better job or in less time than the fair young workwoman. Four years ago, when Miss Nelly began to think of the means whereby she must earn her living, she looked over the whole field of woman's work. Among the trades or occupations which the pushing women of this country have made their own, there was none she especially liked. She was a bright girl, with a great deal of Yankee cleverness, and considerable ingenuity and inventiveness. The remark was made to a friend that she was so fond of inventions she ought to become a machinist. The seed thus idly sown took root, and she applied for a place as an apprentice. For the past four years she has worked faithfully, and a few days ago her time expired, and she is now a full-fledged machinist. She is able to block up a piece of work on the planer, or turn up an arbor on the lathe. She uses the drill or handles the file as well as any man in the shop. Her specialty, however, is tool-making, and to this she proposes to devote herself. She can also draw plans, figure out dimensions, and from the working drawings she can make anything. She is not afraid of the grease and grime of the shop, and her beauty is not in the least marred by a long swipe of dirt across her dimpled cheek, or a spot of oil on her nose. Her hands are not as white as those of some of her sisters, but they are by no means large, though they are very strong. She is a great favorite with her fellow-workmen, and is the pride of the little country village.—*Springfield Republican.*

Egbert P. Watson, Jr.

Egbert P. Watson, senior editor and proprietor of *The Engineer*, will have the sympathy of all who know him, for the death of his son, the junior member of the firm of Egbert P. Watson & Son. Young Watson was, we believe, about thirty years old at the time of his death, and in the expectation of his friends, should have had many more years of usefulness before him.

William M. Cowan.

William M. Cowan, vice-president and treasurer of the Corliss Steam Engine Co., at Providence, R. I., died February 10, after a short illness. Mr. Cowan has, since the death of Mr. Corliss, been manager of the works. He was formerly at the head of the Whiting Manufacturing Co., of New York. In the short space of time he had been connected with the Corliss Company his ripe and extended knowledge of men and business affairs, together with his genial, even, yet firm temperament, had been invaluable in extending its reputation. In his sudden and unexpected death the company has met with a great loss.



Steam Blower and Drier for Furnaces.

The introduction of steam jets beneath the grate bars, for the purpose of producing a forced draught, has been tried with unsatisfactory results. Mr. William McCoy, of Rome, Georgia, claims that the failures of these experiments were due to the fact that the steam was not sufficiently dry; had it been so, satisfactory results would have been obtained. Under these convictions he invented the steam blower and drier illustrated in the accompanying cut. The device is very simple, and can be readily attached to any boiler. Steam is taken from the top of dome on boiler and conveyed through the vertical pipe *G*; this pipe, wherever possible, is encased within the boiler brick-work. At its lower end is attached a reservoir *H*, of any disirable construction adapted to receive water of condensation from the steam pipe, and provided with drip-valve *I*, also of ordinary construction, to carry off the water. A little above the reservoir, a branch pipe *K* is joined to the pipe *G*; the former inclines a little, so as to drain towards the reservoir. The pipe *K* communicates with the perforated tube or distributer *L*; the holes are about $\frac{1}{16}$ of an inch diameter. This distributer is located below the grate bars near the ash-pit door, about 12″ below the grate, and 18″ from the door, gives good results in many cases. The holes in the distributer are placed so that the steam shall be directed to the fire at the same angle as the current of the natural draught; by this means all conflict between the currents of air and of steam is avoided, and a single draught of commingled steam and air is attained. The supply of steam to the fire is regulated by an ordinary steam valve *M*.

The water of condensation, which takes place from the dome to the pipe *K*, falls by force of gravity through the vertical pipe *G* into the reservoir, while the steam is conducted by the pipe *K* to the distributer, supplying the fire with steam of a sufficiently dry state, which will prevent an accumulation of moisture below the fire, and avoid a reduction of the heat. Another advantage of placing the distributer below the grate is that it prevents the overheating of the grate bars; it is also claimed that with this device a better combustion is produced.

The invention is adapted for use in all kinds of furnaces, or for any purpose where dry steam is desired.

The inventor writes us that several of these devices have been in actual use several months for puddling furnaces in the Rome Rolling Mills, with very gratifying results. It greatly reduces the number of clinkers, and almost entirely stops them from adhering to the brick-work and grates. They chip off with but a light blow from a hammer, and doing away with the heavy sledge so commonly used, often destroying the entire brick-work. With this device the grate may be taken out, clinkers removed, grate replaced ready for another charge within a very short time. It is also claimed that the quality of the iron is improved, owing to the more perfect combustion attained with the device.

LETTERS FROM PRACTICAL MEN.

Mistakes in Textbooks.

Editor American Machinist:

In a recent issue, under the head of "A Misunderstanding," your correspondent, E. O. S., makes some sensible remarks about mistakes in mechanical textbooks.

It is evidently to the interest of both the author and reader to have such errors noted, and eliminated in subsequent editions, and most authors will not take it amiss to have their attention called to the same.

Many errors are purely typographical, as for instance, in your answer to Question 70, any old hand at the business would see at once that 22° F., should read 212, but the apprentice who asks for information would be misled.

In Jno. Richards' Manual of Machine Construction, recently mentioned in your book notices, he says on page 70, "If a movement of one hundred feet is to be reduced to one foot, and the intensity increased accordingly, all that is required are two pistons, one of 12″ diameter and the other 1″." Now the relative areas of 12 and 1 are as 113.0 to .785, and not 100 to 1. Isn't there a misfit somewhere?

Again on page 76 he describes automatic engines as those having "a *single* valve arranged for regulation by the range of admission, and also by compression due to trapping the steam on the exhaust side of the piston."

This definition, if I understand it right, excludes the modern Corliss engine from the list of automatics, of which it is popularly considered the highest type.

Instead of using the compression to assist in regulating speed, is it not the aim of constructors to keep it constant at all points of cut-off?

Mr. Richards' text-book contains a fund of useful knowledge, and the price paid for it is an excellent investment.

The early editions of such standard works as Haswell & Trautwine contained errors, but what engineer does not constantly refer to both. E. O. S. is correct, when he advises us to read various books on one subject, and to read thoughtfully. F. A. RIDER.

He Don't Believe in Emery Anyway.

Editor American Machinist:

My experience with emery tool grinding machines has not been very favorable. I think that grindstones have not been well tried in most places. It has been my experience to see them generally abused. I think if some of the men who are in charge of machine shops would try to grind a thread tool accurately—to gauge—on one of their square grindstones, which is usually found to be revolving around one of its corners, they would give their workmen credit for some hand skill, if not brain power.

The working machinist is usually ignored when any subject comes up that requires any thought. The draftsman or engineer is usually supposed to know all about all matters relating to machinery, whether they ever had any practical experience or not.

I would like to offer a suggestion to all those who choose to use these ill-kept grindstones: Suspend a swinging crane from the ceiling over the center of the grindstone, or rather the shaft. On its lower end arrange a comfortable seat for the workman; also a small truck to bear against the grindstone just below where the man intends to grind. With this arrangement it need not make any difference how much the stone is out of truth, so long as the man does not object to his ride.

I understand from the letter of Mr. Norton that he thinks if emery wheels were made soft, as grindstones are, all difficulties would be overcome. I think I can see how this would be good in some ways, but in others bad. Suppose a grindstone, when new, to be 4 feet 6″ inches in diameter, by 6″ thick, and if worn down to 2 feet 6″ is considered to be used up. In this case we would have about 9,503 cubic inches for use.

In the case of the emery wheel I think that about 24″ in diameter by 2″ thick would be common practice for a wet tool grinder. This wheel usually has an iron center, and, I think, is not usually worn below 16 inches diameter. This would allow about 503 cubic inches for use.

If the grindstone would last in the shop three months, and the emery wheel was equally soft, so as to wear away as fast, it would last a little more than four days.

Mr. Walker says that it would be a sad commentary upon the mechanical judgment of the people of the age, to find that they had been making a mistake in using emery wheels for tool grinding. I have heard of a man who owned an eight-day clock, but wound it every night for over forty years before he found out that it would run eight days. He might have thought this a sad commentary upon his judgment, but I do not think he took the matter to heart enough to continue to wind his clock so often.

I do not know that any one can answer the question asked by Mr. Norton: "Are you quite sure you know of all the uses we put emery wheels to?"

I know that emery wheels are used for grinding cylindrical work, both on iron and steel, both hard and soft. I also know that they have been used for grinding brass. I do not know that this is good practice. Any practice is good when it is the best we can do. The old barbarians used to bring some of their work to shape by wearing with stones. This was good practice for them, for it was the best they could do. I think the case with us is sometimes the same in finishing steel. Some say that the work can be done better by grinding. What does this amount to if the work is done well

enough in the lathe? I do not believe any one can prove that a lathe spindle that is ground will give any better results in actual use than one fitted by a good machinist on a good lathe. I think the most of machine work can be done cheaper on the lathe.

I have seen 75 feet of 3-inch shafting turned and finished in ten hours. I understand that a great deal more than this has been done. I do not know that this amount could be turned and ground in this time.

I also do not think that a ground bearing on soft stock is as good as one turned. There is always left in the mind of a practical man a bad feeling—that there is emery left sticking in the surface.

Are you quite sure that you can grind soft brass without leaving some emery in the surface? I think we can make a good lap in this way.

In grinding to size a number of like small pieces we have to find the size by trial on each. In the lathe we can, after finding the size for one, keep the tool in the same position and size a great many. Lathe improvements may not be all in yet. I never saw a good follow rest on any lathe that was handy to use, when making change to suit the work. Would it not be better to perfect the practical man's idea, and try to make the conditions the same in turning the long, slender shaft by the use of a proper follow rest, than to perfect the amateur's way of doing the cutting with a very sensitive touch?

I believe that emery was first introduced nto the machine shop for the purpose of polishing—"Some people must have style if they do not make a cent." I think emery has caused more trouble in the construction of machinery than it ever did good.

A MECHANIC.

Emery Wheels and Grindstones.

Editor American Machinist:

Professor Sweet's letter concerning Grindstones *vs.* Emery Wheels has, no doubt, awakened a train of thoughts in a great number of minds throughout the country—my own among the rest. One thing I think I may safely say, and that is that nine out of ten machinists prefer the grindstone to the emery wheel for finishing an edge tool; at least, such has been my experience, and, for my own part, quite agree with the majority. But methinks the fault lies in the fact that the emery wheels usually found in machine shops are not of the right grade to adapt them to the class of work required of them. They are generally of a medium grade—not coarse enough to remove a lot of stock rapidly, and not fine enough to finish edge tools. As a rule they are used wet, and, no matter how much water you use, the result is, the temper is drawn more or less, and this seems to be the objectionable feature of the emery wheel for edge tools.

Now it appears to me the manufacturer has made this tool "to sell, and satisfy the agent and salesman," as Mr. Paret puts it, and these agents, not really knowing what use that particular grade should be put to, and being gifted with no small amount of persuasive power, assures the buyer, "It's the very thing you want." The buyer gets his wheel; result—dissatisfaction.

Surely the manufacturer should look to this, and not let the machinist have to go back to the days of yore; for I cannot but believe that the emery wheel ought to supersede the grindstone.

C. K.

Loam Moulding.

BY S. BOLLAND.

THIRD PAPER.

HOW TO MAKE A CYLINDER WITH STEAM WAYS, FOOT AND END CAST ON.

My object in using the plain cylinder as the first lesson was that I might be able to fully explain the rudiments of the trade, as well as to give some idea of the use of materials and tools required; and presuming that you are sufficiently well drilled to make a plain casting in loam, I will now take up something a little more difficult to make. The task before you is chosen on account of the facility it offers for bringing into play, principles, which, if firmly grasped, will enable you to understand what you are doing, and qualify you for work still more critical.

Fig. 44 is a sectional view of cylinder cut through at the middle, showing the mode of making the same. You will observe that the end is cast on, which necessitates another kind of bearing and cope ring.

Fig. 45 shows cope ring with extension on front to carry the steam chest (see that you do not cover one of the bottom lugs when you place it on the seating). Sometimes it is necessary to lift the core of this class of work, in which case a seating must be struck as shown at *A*, Fig. 44. *B* shows lifting plate with studs cast on to meet plate for bottom of core. *C* shows covering plate with hook bolts for securing *B* to *C*. Fig. 46 is a plan of plate *C*, showing holes for hook bolts to come through, and staples for securing the whole to lifting plate. *D*, Fig. 47, shows plan for same. As seen at Fig. 44, the bearing is first struck to *E*, after which the flange

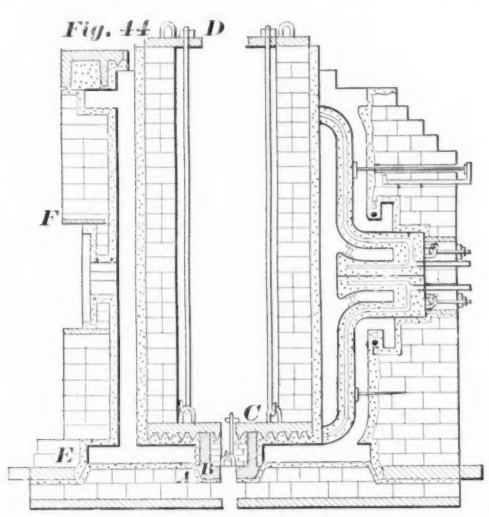


Fig. 44

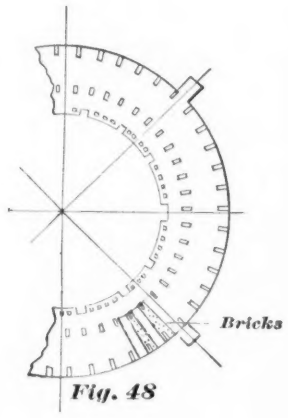
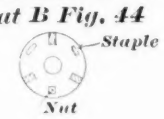


Fig. 48

Plan at B Fig. 44



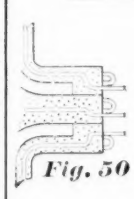


Fig. 50

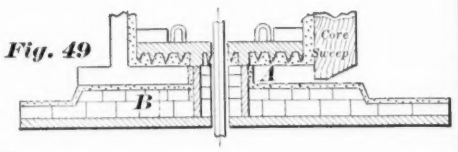


Fig. 49

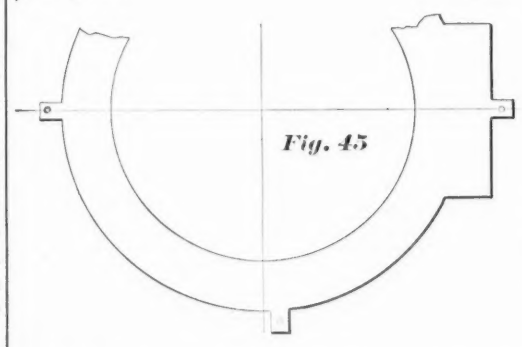


Fig. 45

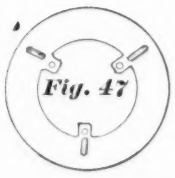


Fig. 47

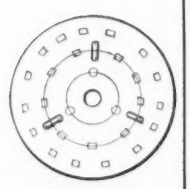


Fig. 46

is struck, and cope built. Sometimes you will have to set the foot and chest to drawing, but, as the pattern maker is usually on hand at this juncture, you will get along all right by his assistance; but a good plan, and one that insures absolute correctness, is to have a bottom flange made to rest on bearing at *E*, on which a frame can be constructed with four uprights tied by another flange on top; to this frame can be attached anything you may have to cast on the body. After centering the frame and securing it you can (by the use of a guide-stick reaching from flange to flange) build up your mould; after which, when you have taken out the top flange and uprights, you can fasten your sweep to the spindle and strike up the cope.

In building this cope on the foot side you will observe irons, which must reach from side to side to support the bricks above the foot as well as to tie the small space below, and in all confined spaces place a few straws and bring them to the outside, taking care to carry all such vents up to the top when the mould is rammed up. At *F* is seen a plate which is needed to carry the overhanging brick-work. A bearing must be left all round the foot, against which you place a core cake or plate when you close the mould. Don't forget the guide around the top; and cinder the joints of the bricks well. On the opposite side you will observe more need for care in securing across and behind the flanges. Suitable spaces must also be left for bolting back the cores and securing the vents.

The covering plate differs, as you will see, from the last one; as in this case the body core comes through, making it necessary to cast slots in the inner edge for the runners, as seen at Fig. 48. The inside diameter of top covering plate, when swept, must be a little slack of the body core, to insure its slipping on without damaging the mould. After the cope is lifted away take off the finger which is screwed on the seating board, spoken of in connection with bottom flange, and shown by dotted lines in Fig. 26, and sweep on the bearing the thickness of the inner bottom flange with old sand, as before described. It is well that you cover the prickers of the bottom core plate *C* with stiff loam, and dry it in the oven before you come to this point, so that it will be ready for use when you want it; care must be taken to keep the prickers clear of the places which must meet the studs in plate *B*. In making the small plate *B*, have your studs long enough to reach the face of core plate *C*, allowing $1\frac{1}{2}$" for prickers and $\frac{1}{2}$" for loam. You now oil the small seating and set in plate *B*, bed it down solid with no loam under; brick up firmly, bedding the bricks well down level with the top of flange, clean off the core plate *C*, turn it over and see that it rests fair on the studs; after satisfying yourself on this point, and observing the thickness of loam required under the plate, which, as stated before, must not exceed $\frac{1}{8}$", rub a little soft loam on the plate *C*, and bed down on a bed of soft loam, making sure that you touch iron and iron on the studs. You must now put on your nuts, and screw them firmly together.

Another plan is to cast nuts in plate *B* instead of staples, and threading both ends of the bolt. You now set the core sweep and run up the core as shown in Fig. 44. The top plate is bedded on and screwed down after the core is swept. By this method you are at liberty to close your mould either by lowering cope over core or lowering body core in last, which is to be preferred in some instances.

Should it not be required to lift the core out, a method is shown at Fig. 49. As will be seen, the bearing for core comes level with the top of thickness at *A*; by building studs up from bottom plate level with bearing, and casting studs on core plate (to meet them) as much lower than the prickers as there will be thickness of loam. In this case you may build as much of the bearing as you need for building the cope as shown by dotted line at *B*. When the cope is lifted away you can build the remainder of the bearing, finish and blacken. The bottom core plate in this instance you may either ram up with dry sand facing, or sweep it with loam level with the studs; after this is dry, finish and blacken, and, when turned over, rest it in its place, stud over stud. This may be bolted down through the center when the spindle is withdrawn. You can now fill up the flange space with waste, and build the core.

In large cores, where bearing sufficient can be had to support the core with safety, the studs can be omitted; but be very sure before you venture on a core of this kind without them.

It will be observed that this body core comes through the top plate, consequently it must be secured under the cross before casting, in the same manner as directed for cope. Fig. 44 shows the whole set of cores divided at the center of the exhaust; this is a good plan when the whole set would be too bulky. After the chaplet is set to the correct thickness the bottom half can be placed in and bolted back, after which the top half can be set to its place very readily, and secured in the same manner. Where cores can be thus made, it is far the best and safest; but when (as is often the case) you must have all the cores separate, be sure and have your prints a good length, retaining the thickness between the port and exhaust on the port core; by so doing you will add strength to the port core, and make it safer to handle. Fig. 50 explains what I mean.

For cores which are made separately, have the irons bent to shape, and cast them into cast-iron prints, that will enter the core-box slack; the vent holes must be cast in, also the staple for bolting back. Be sure in all cases to arrange your brick-work so as to be able to get at your joints and vents handily; and use pipes for leading away the vent wherever you can, as it is the safest.

Steel Pipes.

Steel pipes as a substitute for cast-iron now form an important item for the engineer's consideration in Transvaal works, inasmuch as during the past year the transport from Kimberley to Johannesburg, a distance of only 300 miles, cost not less than £30 per ton at the time of the drought, and even in good seasons the cost of transport per ton is as much as from £12 to £15, consequently any substitute for the heavy cast-iron pipes is a desideratum. Steel pipes are being adopted because they are only about one-quarter of the weight of cast-iron pipes of the same internal diameter, and they are less liable to fracture than cast-iron. For the water supply of the City of Pretoria, Messrs. James Russell & Sons, of Wednesbury, have obtained the contract for manufacturing some twenty-seven miles of steel pipes for this particular supply. The same firm supplied the pipes, or a portion of them, for the Kimberley Water-works in Cape Colony, which have done good service. The consulting engineers for the Pretoria Water-works are Messrs. E. Pritchard & Co., who are also the engineers for the proposed scheme for the supply of water to Johannesburg and neighboring gold mines, where over 4,000 tons of pipes will be required, as well as for the water supply of Klerksdorp, another prosperous town near to Potchefstroom, and second only to Johannesburg.—*The Engineer* (London).

The fact that few orders are just now being booked by British shipbuilders leads to considerable fear that there may be a lull in the business, and dull times in the yards when the orders now on hand are worked off. High prices have ruled for a long time.

AMERICAN MACHINIST

Communications relating to the reading columns should be addressed to the Editor. All other communications should be addressed:

AMERICAN MACHINIST,
96 FULTON ST., NEW YORK.

PUBLISHED WEEKLY AT
96 Fulton Street, New York.

HORACE B. MILLER, Pres't and Bus. Manager.
LYCURGUS B. MOORE, Treas. and Sec'y.

F. F. HEMENWAY, Editor and Mech. Engineer.
J. G. A. MEYER, } Associates.
FRED J. MILLER, }

Special Announcements.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once. Date on wrapper denotes week with which subscription expires.*

Subscription.

$2.50 a year in advance, postage prepaid in the United States, Canada, and Mexico.
$3.50 a year to Other Countries, postage prepaid.

Advertising.

Transient, 35c. per line, each insertion.
"Business Specials," 50c. a line.

The American News Company,
Publishers' Agents, New York.

The International News Company,
11 BOUVERIE STREET, Fleet Street, LONDON, ENG., will receive subscriptions for the AMERICAN MACHINIST, at 14/7 per annum, postage paid.

DEALERS SUPPLIED BY

The Albany News Company, Albany, N. Y.
The American News Company, New York, N. Y.
The Baltimore News Company, Baltimore, Md.
The Brooklyn News Company, Brooklyn, N. Y.
The Buffalo News Co., Buffalo, N. Y.
The Central News Company, Philadelphia, Pa.
The Cincinnati News Company, Cincinnati, Ohio.
The Cleveland News Company, Cleveland, Ohio.
The Colorado News Company, Denver, Colorado.
The Detroit News Company, Detroit, Mich.
The International News Company, New York, N. Y.
The Minnesota News Company, St. Paul, Minn.
The Montreal News Company, Montreal, Canada.
The National News Company, New York, N. Y.
The Newark News Company, Newark, N. J.
The New England News Company, Boston, Mass.
The New Orleans News Company, New Orleans, La.
The New York News Company, New York, N. Y.
The Northern News Company, Troy, N. Y.
The Omaha News Company, Omaha, Neb.
The Pittsburgh News Company, Pittsburgh, Pa.
The Rhode Island News Company, Providence, R. I.
The San Francisco News Co., San Francisco, Cal.
The South West News Company, Kansas City, Mo.
The St. Louis News Company, St. Louis, Mo.
The Toronto News Co., Toronto, Ontario, Canada.
The Toronto News Co., Clifton, Ontario, Canada.
The Union News Company, New York, N. Y.
The Washington News Company, Washington, D. C.
The Western News Company, Chicago, Ill.
The Williamsburgh News Co., Brooklyn, E. D., N. Y.

NEW YORK, MARCH 6, 1890.

CONTENTS.

	PAGE.
A New Compound Engine	1
The Speed of Grindstones	1
Something About Steel. By S. W. Goodyear	2, 3
Shop Notes. By Jarno	3
54-inch Lathe for Gun Work	3
Machinists' Hammers	4
Practical Details of Blacksmithing. By B. F. Spalding	4
Ventilation by Disk Wheels	5
The American Patent System. By D. Walter Brown, Ph. D	5, 6
A Girl Machinist	6
Egbert P. Watson, Jr	6
William M. Gowan	6
Steam Blower and Drier for Furnaces	6
Letters from Practical Men: Mistakes in Text Books. By F. A. Rider—He Don't Believe in Emery Anyway. By A Mechanic—Emery Wheels and Grindstones. By C. R.	6, 7
Loam Moulding. By S. Bolland	7
Steel Pipes	7
Look to the Comfort of Passengers	8
A Comparison	8
Literary Notes	8
Questions and Answers	8, 9
Manufactures	9
Machinists' Supplies and Iron	10

Look to the Comfort of Passengers.

To transport the multitude of travelers and business men of New York, who have their homes in the suburbs of the city or towns near by, no doubt taxes the ingenuity of railroad men, and they deserve credit for handling the large number of trains so successfully as they do. But there is considerable room for improvement; we refer to the comfort of the passengers. A railroad company does not perform its whole duty if the utmost attention to the comfort of passengers is neglected, and an overcrowding of cars permitted.

Many of the commuters are extremely busy men, and would appreciate the opportunity of devoting the time spent in the cars to attentive study or reading, which is so often prevented by overcrowding. The consequence is that many prefer to live in the city, or seek their residences in a proximate vicinity, thereby avoiding the discomfort of traveling, saving as much as possible of their valuable time, and setting an example which deters others from becoming patrons of the railroads.

From a railroad man's standpoint it may seem to be economical management to keep the rear cars of a train locked until the passengers are packed in the front ones like sardines, and then run with as few cars as possible, sometimes leaving the wayside passengers to take care of themselves, and stand up until some one steps out. But from a thorough business standpoint we believe such overcrowding to be a hurtful policy, as it tends to keep the passenger traffic at a minimum, prevents the growth of the suburbs, and interferes with the development of a remunerative business. That crowded cars are objectionable, the railroad officials acknowledge by the fact that private cars are provided for the chief officers.

We would suggest to keep for the use of commuters only, one or two cars on each train during the busy hours of the day, giving them at least an opportunity of thinking or reading without being disturbed by overcrowding. If the wealthy companies object to this plan, it would be well for some of the smaller companies, who compete with their wealthy rivals, to try it; the appreciation would soon manifest itself by an increase of the earnings. As for the fact of compelling passengers to stand, as we have frequently seen, there is no excuse. We interpret the act of a gentleman offering his seat to a lady in an overcrowded car as an apology for the carelessness, neglect of duty, or incompetency of railroad officials. On the other hand, an earnest effort to promote the comfort of passengers, polite treatment, and an effort to keep the depot clear, so that express trains will not be delayed 15 to 20 minutes before the passengers can be landed, will certainly be advantageous to all concerned.

We can remember when the companies thought they were rendering excellent service by running the ferryboats every fifteen minutes; now they are run, during the busy hours, every ten minutes, and in one case every seven and a half minutes. This improvement is appreciated by the traveling public. But with the constantly increasing traffic is it right that the companies should feel satisfied with the service they render? Cannot further improvements be made? It seems to us that a more general application of the steam steering gear to the ferryboats would enable the pilots to maneuver their boats with greater ease, run around passing tug-boats, scows, etc., and shorten the time of crossing, which may enable the companies to run the boats every five minutes when the traffic demands it. Above all, the loading of the ferryboats so as to cause them to list should be prevented; there is nothing so annoying to nervous passengers as to be compelled to trust themselves on boats with one paddle wheel nearly out of water. Running boats in this manner may be considered safe enough, but it indicates carelessness.

A novel question of law has been raised by a suit brought against the Northern Pacific Railroad Company by the widow of an engineer who was killed in a collision on that road, which occurred in Idaho. The claim is set up that, as the death occurred in Idaho, there is no legal limit to the amount of damages which can be recovered, because the statute of Idaho fixes no limit, as is the case in some States. The law of Idaho provides simply that just compensation can be recovered, and the widow in this case puts her damages at $60,000.

It would seem as though the law of the place where the accident occurred would govern in such matters rather than the law of the State in which the company is incorporated.

A Comparison.

No doubt most of our readers have read during the past week of the death of Mr. John Jacob Astor, and of the fabulous wealth he possessed. The press has teemed with accounts of his vast wealth, of his comparatively simple and unostentatious life, and of his many and magnificent charities.

Many a poor mechanic reading these accounts will be disposed to grumble somewhat at his lot, and to wish that things could be arranged a little more evenly. Mr. Astor carried on no manufacturing or commercial business of any kind, but derived his immense income of $5,000,000 a year, or nearly $16,000 for every business day, from his holdings in real estate, most of the amount which during his life he added to the wealth inherited from his father, being due to increase of land values in New York City, which, of course, were caused chiefly by the manufacturing and other productive enterprises of others. He was never accused of a dishonest or dishonorable act, and many people in need of assistance of various kinds have in the past, as they will in future, have cause to rejoice that he lived. He was a good man, and we have no desire to detract in the least from his good name.

But there can be no harm in drawing a comparison between his life and the methods by which his vast wealth was piled up, and the lives of others who, by labor of various kinds, earn and give a full equivalent for every dollar they possess before possessing it. As an illustration, we may take the case of George H. Corliss. Mr. Corliss died a wealthy man; not nearly so wealthy as Mr. Astor, of course, but still quite wealthy. Consider now how he made his money. In the early days of his illustrous career, soon after he had perfected his engine, it was his custom to go to the owner of a mill where an old-fashioned throttling engine was running, and offer to put in one of his engines to do the same work, and take as his pay for the engine the saving in coal for a few years, or for a fixed sum, as preferred by the purchaser. No matter what his rate of profit might have been on the engines so furnished, nor how high the price may have seemed to be, it must be conceded that engines sold in such a way were cheap. A single transaction will illustrate this. In the town of Newburyport, Mass., he offered to replace what had, up to his time, been considered first-class engines by a pair of his engines for $10,500, or for the saving in coal during five years. The purchasers elected to pay him the saving for five years, and the engines cost them $19,734, or practically double the price asked for them in the first place. But after the five years were up the engines went on saving coal as before, and for aught we know are still saving it, thus making it a most profitable investment for the owners, no matter if the price was high.

It cannot be doubted that George H. Corliss fairly earned every dollar he owned before he received it, and the benefits he conferred upon society are immeasurable, far surpassing the wealth he was able to amass, no matter how much that may have been. The same may be said of John Ericsson, who, however, died comparatively poor.

It has been said that comparisons are odious; but we do not wish to make this comparison odious. It is not made for the purpose of detracting from Mr. Astor, but for emphasizing the fact that the life of the man who, before he asks for the payment of a single dollar to him, shows that he has produced and offers in exchange for that dollar something of equivalent value, is far more useful to the community, and is a far better example to be held up for emulation, than is the life of a man who enjoys great wealth without having produced an equivalent for it, however honest and lawful his methods may have been. The humblest mechanic who is honest and conscientious, who persistently does the best he can, though he will never become as wealthy as John Jacob Astor, may become as wealthy as George H. Corliss, and whether he does or not he will have the satisfaction of knowing that he has returned a full equivalent for every dollar, and he may also take what satisfaction there may be in knowing that the value of his services, as compared with the other kind, are gradually but surely becoming better understood every day.

Literary Notes.

THE DEVELOPMENT OF THE PHILOSOPHY OF THE STEAM ENGINE. An Historical Sketch. By Robert H. Thurston. New York: John Wiley & Sons.

The matter which goes to make up this little book was for the most part embodied in a paper read before the British Association for the Advancement of Science at the Montreal meeting, in 1884. Some revisions have been made and a little matter added where it seemed necessary to completeness.

The author shows that while the theory of the steam engine is not complete, enough is known to help the designer to a pretty correct knowledge of performance in advance.

ELECTRIC LIGHT INSTALLATIONS AND THE MANAGEMENT OF ACCUMULATORS. A Practical Handbook. By Sir David Salomons, Bart., M. A. Assoc. Inst. C. E., Member of the Council of the Institution of Electrical Engineers, Member of the American Institute of Electrical Engineers.

The fact that this work has reached the fifth edition, besides being translated into French and German, is sufficient proof that it has met a demand which it has satisfactorily supplied. The opportunity has been taken of thoroughly revising and greatly enlarging the work, many new cuts having been added. Some entirely new chapters have been added, and several errors which occurred in previous editions corrected.

The book is intended to be, and is, a practical one, but it is assumed that the reader has a general knowledge of electric lighting, such as may be obtained in practice or in the more elementary works; minute details being therefore not given in this.

The book in its present form will no doubt prove more popular and more useful than ever. It is published by Whittaker & Co., London, and D. Van Nostrand Company, New York. Price $1.50.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(86) A. H. A., Jewett City, Conn., writes: I have a well from which I take water to be used in my boiler, and I find that around a plug where it leaks there is some lime deposited. Will the lime form a coating on the inside of the boiler? Would it be advisable to change the water? *A.*—It will form a coating on the inside of boiler. Change the water if possible. If not, purify it.

(87) D. F. M., ———, asks: How are chilled rolls turned? What kind of tools are used, and how made if peculiar? *A.*—If the rolls are straight and plain, they are turned by means of broad and flat tools, which are clamped firmly to the rest, and fed straight in. The width of the tool depends upon the power of the lathe, but is usually about 4 inches. Where bars or shapes are to be rolled, the tools are of corresponding shapes, and are fed in the same way. The cutting speed is very slow.

(88) E. A. H., Ottawa, Ill., sends us a sketch of an air tank with an arrangement for the purpose of regulating the pressure in the tank; the air is taken from a large storage tank. He asks Can I maintain in it an approximate pressure of 7 or 8 pounds, the pressure in the storage tank being 10 pounds per square inch? *A.*—Yes, if the device is properly constructed.

(89) C., Bridgeport, Conn., writes: We have a 20 horse-power slide valve engine; the valve is not automatic, but is adjustable by hand. We wish to get only from 8 to 10 horse-power from this engine. In your opinion, would it be better to run the engine at 130 revolutions with 40 pounds steam, or at 150 revolutions on 60 pounds? *A.*—We should not reduce the steam pressure. If the regular speed of the engine is 150 revolutions, you could probably effect a little saving by reducing the revolutions 15 or 20 per cent., and cutting off early. It is impossible to speak very definitely without knowing more about the engine.

(90) H. M., ———, asks: Which one of the three gears, viz: belt, spur gear, or worm gear, requires most power to drive it *per se?* That is, if I have an elevator, for example, which one of those gears will require most power to drive the elevator empty, and in what proportion do the amounts of power required compare with each other? *A.*—Worm gear will, under ordinary circumstances, require most power to drive it. The loss by well-designed and constructed spur gears is about equal to that of belts. Much depends upon design and workmanship, but usually about the best obtainable efficiency with worm gearing is .5 to .7. With spur gears or belts .9, or over, may be obtained. These figures may be modified, however, by changes of speed and pressures upon the working surfaces.

(91) J. P. L., Palmyra, sends us a tracing of a locomotive fire-box, in which no crown bars are used, the crown sheet being braced by long, direct stays between the furnace and boiler crown sheets. He asks if this method of bracing is a good one, and, if not, what are the objections. *A.*—This method of staying crown sheets is not a new one; it is now used on many railroads. Its advantages are that it gives a near approximation to an unobstructed crown sheet, giving the sediments only a small chance, or comparatively none, for collecting on the crown sheet; hence, for muddy feed water this method is almost indispensable, and is looked upon with favor by many master mechanics. It offers but very little obstruction to the rising of the steam globules as they are formed on the crown sheet, and allows a freer circulation of water in that part of the boiler where the evaporation is most rapid. On the other hand, the objection to this system of staying is the difficulty of obtaining perfect threads in the sheets for the stays, and is therefore considered not to be as safe as crown bars; hence, for good clean water the latter are often preferred.

(92) S. B., ———, writes: We are running our 10″x12″ engine, 200 revolutions, using four drops of cylinder oil per minute, and exhausting into a heater; the condensation allows a good many gallons of water to run to waste. We want to save this water. Can we pump it back into the boiler without using a separator? Will that amount of oil be liable to cause foaming? Can we not use a deep tank to catch drip, pumping from the bottom, and always having water well above suction pipe, and, when necessary, blowing off? *A.*—If you use a pure mineral oil there is not likely to be any trouble. But with the made up oils so largely used at this time we should not be willing to let it go in the boiler. All animal oils are likely to cause foaming, especially if the boiler is not thoroughly cleaned, quite frequently making trouble in a boiler. Most water contains impurities, and these are likely to form a paste with the grease, preventing the free passage of heat, and hence overheating the boiler in some of its parts; so that, if it does not cause foaming, it may do worse. You can probably get rid of some of the oil in the way you speak of, but when mixed under the conditions of passing through the cylinder together, it is generally found a difficult matter to separate oil and water by settling.

(93) J. H. E., ———, asks: 1. I have a lot of knives to temper—several thousand—and they must be a dark blue. They are about 1½ inches wide, 3 inches long, and ⅛ inch thick. How can I temper them rapidly? Is there any furnace or oven that could be heated to just the right temperature? *A.*—There are furnaces which could be heated to the right temperature, but the best plan, perhaps, would be to put them in sand in an iron vessel which is then held over a fire and shaken, to keep the heat uniform. 2. Can you give me the address of some office of the Nicaragua Canal Co., where I could apply for a situation in their machine department? *A.*—We have not the address required. 3. How can a full report of the meetings of the American Society of Mechanical Engineers be obtained? *A.*—By addressing the secretary, F. R. Hutton, 64 Madison avenue, New York City. 4. How near can two shafts be to run an 8-inch belt, quarter turn, over 24-inch pulleys economically? *A.*—Something depends upon what the standard of economy may be, but they should not be less than ten or twelve feet apart. 5. Would it be good practice to fasten a single wire rope sheave directly to the engine shaft in transmitting power? *A.*—It is not commonly done, but we can see no objection to it, and would consider it good practice where the conditions called for that kind of transmission.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday for the ensuing week's issue.

Gear wheels and g-cutting. Grant, see adv., p 16.

Link-Belting and Sprocket Wheels.
Send for Catalogue of Link-Belting.
Over 50,000,000 feet of Link-Belt in use.
Link-Belt Engineering Co., Philadelphia and N.Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Graduating Machines. A. T. Koopman, Chicago.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

"The Bulldozer," a new departure; forging by pressure. M'f'd by Williams, White & Co., Moline, Ill.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Davis Key-Seating machines kept in stock by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

The best Upright Hammers run by belt are made by Jenkins & Lingle, Bellefonte, Pa.

Ice and Refrigerating Machines, 140 sold, and all successful. David Boyle, 521 Monroe st, Chicago, Ill.

"How to Keep Boilers Clean." A 96-page book mailed free by Jas. E. Hotchkiss, 120 Liberty st., N.Y.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Castings for small and medium-sized vertical engines. Humphrey's Foundry, Bellefontaine, Ohio.

Universal and plain Milling Machines. Pedrick & Ayer, Philadelphia, Pa.

Portable Cylinder Boring Machines. Pedrick & Ayer, Philadelphia, Pa.

Whiton's Chucks. S. A. Smith, 23 S. Canal st., Chicago, Western Representative.

Light Special Machinery and Tools to order. The Meriden Machine Tool Co., Meriden, Conn.

For the latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

Send $1 for Catalogue D, Fine Tools and Supplies. Over 550 pages. Fully illust'd. Free when $10 worth goods are ordered. Frasse & Co., 92 Park Row, N. Y.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

Curtis Pressure Regulators. Curtis Return Trap. Curtis Damper Regulator. See Feb. 27, p. 15. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

Patent Attorney. R G. DuBois, 715 11th st., Washington, D. C, procures first-class patents on inventions. Valuable Hand-book on patents free.

S. W. Card & Co., Mansfield, Mass., make everything in the line of Taps and Dies. S. A. Smith, 23 S. Canal st., Chicago, Western Agent.

The Sure Grip Steel Tackle Blocks must fill the bill, according to the large sales reported. See advertisement, page 13.

Watch this column for our Weekly Announcement of Bargains. Selling Overstock. McFadden Co., 1,025 Market st., Philadelphia, Pa.

Patents.—Patent soliciting of high class.
D. Walter Brown, 31 Nassau st., New York.

Send for "A Brief History of Patent Legislation in the United States."

25″ 28″ 32″ 36″ Upright Drills a specialty. Finely made, great capacity, quickly operated, prices low. Send for list of firms using our Drills. J. E. Snyder, Worcester, Mass.

25″ 32″ 37″ 42″ "Only Drill Press built on 'Ko rekt' principles, even if they come from Jersey." Gould & Eberhardt, New Ark, N J.

Standard Reducing Valve, Standard Pump Pressure Regulators, Improved Collignon Cylinder Oil Pumps, Jenkins Globe and Angle Valves. Send for circulars. Standard Regulator Co., Buffalo, N. Y.

Every draftsman needs one. The Engineer's Sketch Book of mechanical movements, appliances, devices, contrivances, etc., by T. W. Barber. 1,936 illustrations. 8vo. cloth, $3. Catalogue of books on mech. subjects free. E. & F. N. Spon, 12 Cortlandt st., New York.

Superintendents of industrial establishments will find the *Engineering and Building Record*, published weekly at 277 Pearl st., New York, useful. Municipal and building engineering problems a prominent feature. Specimen Copy, 10 cents.

De Lamater Screw Propeller Wheel made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co, New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Stub Ends and Connecting
Rods for small connections.
Especially adapted for Valve
Rod for Steam Engines.
T. C. Dill Machine Co.,
Philadelphia, Pa.

Just concluded. "Practical Drawing." By J. G. A. Meyer. Copies of the American Machinist containing the above series of 93 articles sent by mail to any address in the U. S., Canada or Mexico, for $4.65, or single copies 5 cents each. American Machinist Publishing Co., 96 Fulton st., New York.

H. B. Roelker, 22 Cortlandt st., New York, late Sup't De Lamater Iron Works, will hereafter manufacture the De Lamater Screw Propeller. Propellers of same pattern and workmanship as formerly made by the De Lamater Iron Works. Each designed for its special work at lowest prices. Consulting Expert and Constructing Engineer. Estimates made on machinery and on damages.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 53 East 10th st., New York.

"Binders" for the American Machinist. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton st, New York.

Just concluded. "Modern Locomotive Construction." By J. G. A. Meyer. The above series of 106 articles, which have attracted so much attention everywhere, is now concluded in newspaper form. Copies of the American Machinist containing the entire set sent by mail to any address in the U. S., Canada or Mexico for $5.30, or single copies 5 cents each. American Machinist Publishing Co., 96 Fulton st., New York.

MANUFACTURES

The Nashua (N. H.) Card Co. will build a paper mill.

James Brodie, Little Rock, Ark., will build a planing mill.

Thos. Fox, Dardanelle, Ark., will place some new tools in his machine shop

Moore, Gilchrist & Purdy will build a saw and shingle mill at Morgan City, La.

The oil cloth manufactory of Joseph Rowe, at Gloucester, Mass., was recently burned.

The Troy (N. Y.) Gaslight Company will put up a new plant, abandoning their present one.

The works of the Merrimack Glove Factory at Warner, N. H., were recently destroyed by fire.

Turner & Prout will put wood-working machinery into their planing mill at Barnesville, Ga.

The Union Manufacturing Company, New Britain, Conn., is building large addition to its works.

The Spur Wire Fence Co is the name of a new company at Chicago, to manufacture wire fencing.

W. J. Epperson, Bronson, Fla., will rebuild his saw and grist mill and cotton gin building, recently burned.

The rolling mill of the Minnesota Car Company, Duluth, Minn., recently destroyed by fire, will be rebuilt.

McCoy & Taby have begun the manufacture of the steam blower and drier for furnaces, illustrated in this issue.

The Terre Haute (Ind.) Milling Company's flouring mill was burned Saturday night, causing a loss of $100,000; insurance, $40,000.

The Macclenny (Fla.) Board of Trade will try to establish broom, barrel and bucket, canning and starch factories, and a rice mill.

The Comstock-Castle Stove Company, of Quincy, Ill., has increased its capital stock, and will also enlarge its manufacturing facilities.

It is said that the Roane Iron Company, of Rockwood, Tenn., will take steps at the next meeting of stockholders to build additional iron furnaces.

The Salem (Va.) Development Company has been organized. The company has purchased land and a water power, and is negotiating for the location of large iron and steel works.

The Glen Pulp and Paper Company, of Hartford, Conn., whose mill at Hoosac tunnel was recently burned, has appointed a committee to look into the cost of re-establishing the plant.

The Sharon Iron Co., of Sharon, Pa., will erect six additional furnaces in their puddling department. The company also contemplates several additions to their sheet mill department.

The Piqua Lumber Company, of Piqua, Ohio, has been incorporated, with $50,000 authorized capital, for the establishment of a planing mill, and the manufacture of sash, doors and blinds.

The Palmer (Mass.) Wire Manufacturing Company will start up their mill, which has been idle for several months. There are plenty of orders on hand, and the mill will be run full time.

Part of the Bel Air Manufacturing Company's woolen mills at Pittsfield, Mass., were recently destroyed by fire. The part destroyed is being rebuilt, and operations will be resumed in a short time.

Eleazar Parmly, secretary of the New Howe Manufacturing Company, at Bridgeport, Conn., is building a factory where he will revive the manufacture of the heavy Howe machine, for sewing shoes.

The Star Lumber Company has been incorporated by L. A. Mitchell, of Dodge county, and E. G. Harris, of Macon, Ga., for the manufacture of lumber. The capital stock is to be $75,000.

J. J. McCabe has leased the entire building No. 68 Cortlandt street, New York, and will carry—so he informs us—a large stock of iron-working machinery, bridge and boiler tools, both new and second-hand.

The directors of the Beattie Zinc Company, Fall River, Mass., have made a proposition to the stockholders looking to starting up the works. It is said the proposition is to raise $30,000 from the stockholders.

The Phelps & Bartholomew Company, of Ansonia, Conn., clock manufacturers, have purchased the stone mill on Main street, until recently occupied by Sise, Gibson & Co. The clock company has outgrown its old quarters.

There is water-works agitation at Hillsboro, Tex.; Cameron, Tex.; Rising Fawn, Ga.; Princeton, Ky.; Shell Lake, Wis.; San Angelo, Tex.; Port Falls, I. T.; Princeton, Ind.; Woodstown, N. J.; Romeo, Mich.; Olympia, Wash.; Redding, Cal.; Albina, Ore.

It is stated that a stove foundry is shortly to be established at Provo, Utah Territory, in close proximity to valuable iron mines there, and that the stove founders have offered to take 20,000 tons of the pig-iron product the present year.

The machinery of the Nevins Bagging Company, Salem, Mass., which formerly gave employment to hundreds of employes, but has been closed for some time, will be removed to Greenpoint, L. I., where it will be used to manufacture jute cloth. The real estate and buildings will be sold.

Three large plants are under way in Akron, Ohio. They are The Akron Heating and Ventilating Company, The Star Drilling Machine Company and The Diamond Drill and Tool Company. We learn that The Lodge & Davis Machine Tool Co., Cincinnati, Ohio, have equipped these companies with machine tools.

Henry R. Worthington, New York, has recently received an order for ten Worthington independent condensers. Each condenser is to be used with an engine of 700 horse-power, thus making a total of 7,000 horse-power in one plant. This firm is at present supplying several electric light stations with their condensing apparatus.

At the annual meeting of the Leechburg (Pa.) Foundry and Machine Co., at their office, 130 1st avenue, W. D. Rowan, Geo. Mesta, W. A. Cochran, W. J. Steele and J. W. Poffenberger were elected directors. Owing to their increased capacity and business during the past year, it was voted to increase the capital stock from $75,000 to $100,000.

The Brightman Machine Co., Cleveland, Ohio, are bringing out a special machine for straightening shafting iron at the mills, from 1″ to 4½″ diameter, as fast as it can be rolled. The same machine will also straighten angle iron and rails by simply changing the dies. This company is also making a machine for straightening square and irregular shapes for wire works.

Harvey Scribner, millwright and machinist, Gardiner, Me., whose machine shop was recently destroyed by fire, has consummated a purchase of the fine shop of Joseph Perry in that city, with the stock, machinery, etc., connected therewith. Mr. Scribner will take possession at once, and resume the large amount of work which was awaiting completion at the time of the fire.

A Pittsburgh dispatch says: From a competent authority here it is learned that 2,000,000 tons of steel rails will be needed by the railroads of the United States during 1890. Orders for more than 1,000,000 tons have already been placed in the books of manufacturers for immediate delivery. Last year the total amount of rails was 1,300,000 tons. The cost of the rails for 1890, delivered, is estimated at $66,000,000 to $72,000,000.

Geo. A. Barnard, 15 Cortlandt street, New York, has issued a circular relating to his system of heating and drying by steam. By his system grease can be removed from exhaust steam when it is desirable to do so. The returns terminate in the ordinary return tank, no traps being required. In this tank a partial vacuum is maintained, which draughts from the pipes with great rapidity, leaving no necessity for pressure above atmosphere to force steam through the pipes.

The Carroll Porter Boiler and Tank Company, for the manufacturing and sale of steam boilers, oil tanks, etc., has been chartered. Capital, $50,000. The directors are: James M. Porter, of Sewickley, and James S. McCord and D. W. C. Carroll, Allegheny, Pa. The new building of the company is about completed, and the foundations laid for the machinery, which will arrive soon. The plant is expected to be in operation about the 15th of March.

A company, under the title of the Union Iron Works, has been formed at Erie, Pa., for the manufacture of steel boilers of all types. The company consists of F. F. Cleveland and Wm. Hardwick, of the firm of Cleveland & Hardwick; L. G. Skinner and Frank Connell, of the Skinner Engine Co., together with H. R. Barnhurst, late of the Stearns Manufacturing Co., all of Erie. The company has under way, and nearly completed, a brick building, 60x100 feet. The works will be equipped with the most modern tools, and the company expect to begin operations in April.

A charter has been granted, at Harrisburg, Pa., to the Sheffler Bridge Company. Mr. J. W. Walker, who has heretofore been sole proprietor of the Sheffler Bridge Works, will be president of the new company; Mr. F. L. Geist, vice-president and treasurer; and Chas. D. Marshall, secretary. The directors are: Charles D. Marshall, Howard H. McClintock and James E. Rogers. The new organization will not take charge until April 1, and the amount of capital has not been decided upon. Among recent contracts received by the works is a very good one for a bridge on the Chicago, Milwaukee & St. Paul R. R.

An effort is being made to reclaim valuable meadow land below Philadelphia. This land is flooded in the spring, and frequently at high tide, and the Kingsessing and Tinctum Meadow Co. are to attempt to reclaim it. With a view to test the practicability of doing this, and as part of the extensive plan to that end, this company has placed an order with the Chester (Pa.) Foundry and Machine Company for two sets of centrifugal pumping machinery, complete with engine, boilers, piping, etc. These pumps are each to deliver not less than 24,000,000 gallons per day. Embankments will be made, and a system of canals, and the water forced through the canals into the Delaware river.

Machinists' Supplies and Iron.

NEW YORK, March 1, 1890.

Iron—American Pig.—The bulk of the standard brands continues to be absorbed by deliveries on contracts made prior to January 1, keeping prices steady in these, though inferior brands are occasionally offered at slight concessions. Little new business has been transacted. We quote standard brands No. 1 X Foundry, $19.50 to $20; No. 2, $18.50 to $19. Grey Forge, $17.50 to $18.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Situation wanted as foreman in a stove plate foundry; 20 years' exp. Refs. W. J., Concord, N. H.

Exp'd mechanical engineer and draftsman wants work. Highest testimonials. Box 94, AM. MACH.

Wanted—Educated skillful tool maker, not over 35, with $1,500 to $3,000, as partner. Address S. A. M., AMERICAN MACHINIST.

Wanted—Several first-class machinists for lathe and vise work. Steady employment for good men. Pike Knitting Machine Co., Little Falls, N. Y.

Wanted—Situation as foreman in iron foundry making bench and light floor work. Good ref. Address C. S. F., 31 Madison ave., Detroit, Mich.

A young man, exp'd at mechanical drawing, and a graduate of a manual training school, wishes to make a change. Can give ref. A. M., AM. MACH.

Wanted—A first-class sup't for general machine works employing 30 men. State exp., and salary expected. "Industry," AMERICAN MACHINIST.

Injectors. Wanted—A competent salesman familiar with the R. R. trade. Address Railroad, P. O. Box 1592, Philadelphia, Pa.

Wanted—Machinists, boiler makers and moulders; good general workmen. Address Frick Co., Waynesboro, Franklin Co., Pa.

General machinist and engineer wants to take charge of machine plant. Knows how to handle electric motor or dynamo. Box 93, AM. MACHINIST.

Wanted—A first-class machinist who has had experience in building paper machinery, to take charge of machine shop. Address Box 96, AM. MACHINIST.

Wanted—A few young machinists who have had some experience, on small tools. Men with gumption, competent to swing piece-work. Moseley & Co., Elgin, Ill.

Wanted—A 1st-class machinist to take charge of a plant of special tools for the manufacture of a steam engine regulator. Must be energetic and reliable. Gisholt Machine Co., Madison, Wis.

Wanted—A few 1st-class machinists to learn to use our improved turret lathes. Will guarantee good pay and steady positions to active, reliable men. Gisholt Machine Co., Madison, Wis.

Wanted—A 1st-class man as sup't of a general foundry and machine works. To a live, energetic and thorough man, liberal inducements will be offered. Address Excelsior, AMERICAN MACHINIST.

Wanted—The address of a thoroughly competent foundry foreman who would like to take charge of a small foundry and do work by contract. Address Box 261, Hartford, Conn.

Wanted—Foreman of machine shop in a well-known engine manufactory. Must be familiar with modern methods of economy. Address, with exp. and references, Box 97, AMERICAN MACHINIST.

Foreman pattern maker, 35 years' exp., is open for engagement. Best of references and recommendations. Accustomed to handling men. Brass foundry work preferred. M., AM. MACHINIST.

Mechanical draftsman wanted; one well up in modern marine engine designing and construction, to take charge of drawing-room. Address with reference, Marine Engine, care AMERICAN MACHINIST.

Wanted—A good draftsman who has been accustomed to working on presses, dies and other sheet metal mach'y. Address, stating age, exp., and salary required, Ferracute Machine Co., Bridgeton, N. J.

Machinist and tool maker would like position as foreman of shop or dep't of factory where special machines and tools are made. At present holding such a position, but, for good reasons, wishes to make a change. Refs. Box 92, AM. MACHINIST.

Wanted—A position as foreman or sup't of machine shop, or as M. M. of R. R. shop. Has exp. in every dep't of marine and railroad work, and charge of men. A position in the West preferred. Will be at liberty after May 1. Only a permanent situation desired. Address E. H. P., AM. MACHINIST.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Cheap 2d h'd Lathes & Drills. S. M. York, Clev'd, O.

Graduating Machines. A. T. Koopman, Chicago.

Just out; aluminum-steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, Ohio.

New catalogue of engineers' specialties free. Crescent Mfg. Co., Cleveland, O.

Light and fine machinery to order; Foot Lathe. Catalogue for stamp. E. O. Chase, Newark, N. J.

Turned and Higly Polished Iron and Steel Shafting a specialty. Merwin McKaig, Cumberland, Md.

Complete list of our Scales and other new tools for 2c. stamp. A. T. Koopman, Chicago.

Castings of every description and machinery built. Address Cedar Point Foundry, Port Henry, N. Y.

For Sale—One heavy Hewes & Phillips Planer, 32"x32"x8 ft., in good order and repair. Address Capitol Mfg. Co., Chicago, Ill.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Lord & Co., P. O. Box 1262, Phila., Pa.

Simonsen-Walter Mfg. Co., Jefferson City, Mo., with modern foundry, machine and wood-work plant, wants spec. to manuf. for Western trade

For Sale—Half interest in machine shop and foundry doing a paying business in a good town, can be bought cheap. Address Box 89, AM. MACHINIST.

Inventions or improvements in measuring instruments & other fine tools wanted to manufacture & sell on royalty. "Tools," AMERICAN MACHINIST.

Wanted—A good machinist with about $1,000 in cash as a partner in a first-class machine shop. Address Box 634, Canastota, N. Y.

Wanted—To buy second-hand lathes, planers and shapers of all sizes. Must be cheap and in good order. Fosdick & Plucker, 6th and Culvert Streets, Cincinnati, O.

How to remove and prevent scale in steam boilers at a cost of ten cents a week. Send postal for circular to Pittsburgh Boiler Scale Resolvent Co., Pittsburgh, Pa.

Wanted—Second-hand lathe to swing 60" diameter, bed about 20 ft. long, triple geared, and in first-class order. Address, stating condition, etc., Box 95, AMERICAN MACHINIST.

For Sale—At reasonable price, lathe in first-class condition; 8 ft. swing, 20 ft. bed, gear on face plate, two tool posts, hollow spindle. Address Eagle Iron Works, 250 to 280 Woodbridge st., west cor. 5th, Detroit, Mich.

For Sale—New. A Brown & Sharpe No. 2 Tapping Machine, originally purchased as a spare machine, and never used. Tail rest is adjustable. Tap reverses automatically, and is backed out at quick speed. Drives taps up to 3-4". Inquire of the Neverslip Horseshoe Co., 36 India Wharf, Boston.

For Sale—Machine Shop. Fully equipped; all new tools; in perfect condition; ready to run. Rent of building and power, $30 month. Located in largest manufacturing city in Mass. Reason for sale, extension of business in other directions. A fine chance for the manufacture of specialties. Price $2,500. Address Box 98, AMERICAN MACHINIST.

BRADLEY HAMMERS AND FORGES.
The BEST HAMMERS in the WORLD RUN BY BELT.
Over 1500 In Use.
Three Styles, 15 lb. to 500 lb. Heads.
Our FORGES heat irons fast enough to keep Hammers and men fully employed.
Send for Catalogue and Prices.
BRADLEY & COMPANY, Syracuse, N. Y.
63 Murray St., NEW YORK. 98 Sudbury St., BOSTON.

AN IMPORTANT PRACTICAL WORK
Railroad Engineers' Field-Book and Explorers' Guide.—Specially adapted to the use of Rail road Engineers on Location and Construction, and to the needs of the Explorer in making Exploratory Surveys. By H. C. Godwin. Morocco flaps, $2.50.
JOHN WILEY & SONS, 53 E. 10th Street,
(2 Doors West of Broadway, N. Y. City.)

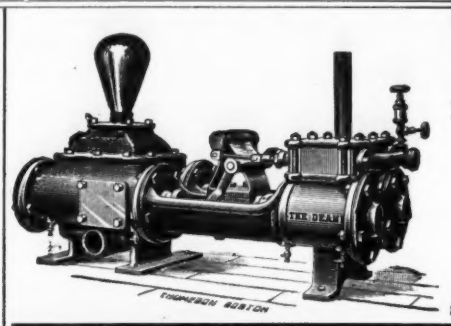
"Star" Foot Lathe Swings 9x25 in.
LATHE
Screw Cutting Automatic Cross Feed, etc.
Scroll Saws, Circular Saws, Lathes Mortisers.
Catalogue Free of all our Machinery
Seneca Falls Mfg. Co., 687 Water St., Seneca Falls, N. Y

3/8" FLEXIBLE METALLIC FILLET
For Pattern Makers' Use.
H. WHITE, 44 N. 4th Street, Phila., Pa.

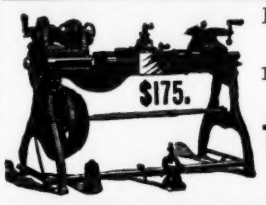
GLEASON MACHINE TOOLS.
Engine Lathes 22 inch to 72 inch swing.
Iron Planers 26 inch to 84 inch wide.
Special Characteristics: Great weight, Great Power and Excellent Workmanship.
HILL, CLARKE & CO.,
156 OLIVER ST., BOSTON.

8,000 SOLD. EVERYBODY'S HAND-BOOK OF ELECTRICITY.
By Edw. Trevert. 50 illustrations, 120 pages. With Glossary of Electrical Terms and Tables for Incandescent Wiring. Paper, 25c. Cloth, $1.00. Postpaid. Agents Wanted.
BUBIER PUBLISHING CO., LYNN, MASS.

IMPROVED PUMPING MACHINERY | For Every Class of Work | Send for New Illustrated CATALOGUE.

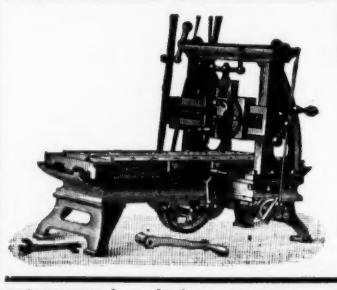

THE DEANE STEAM PUMP CO.,
HOLYOKE, MASS.,
New York, Boston, Chicago, Philadelphia, St. Louis,
Manufacturers of
STEAM and POWER
PUMPS
FOR ALL PURPOSES.
SEND FOR CATALOGUE.

SHEET STEEL
Of Various Qualities and all Gauges,
For Knives, Saws, Scissors, Springs, &c.
CRESCENT STEEL CO.,
64 & 66 SO. CLINTON ST., CHICAGO, ILLS.
136 FIRST AVENUE: PITTSBURGH, PA.
480 PEARL STREET, New York, N. Y.



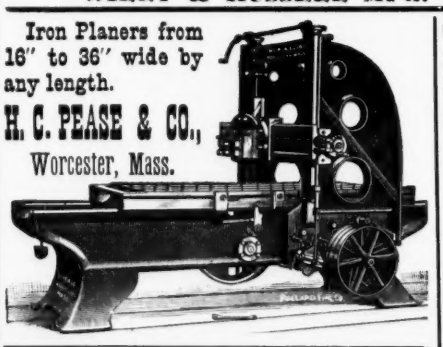
Improved Screw Cutting Foot and Power LATHES
Drill Presses, Shapers, Band, Circular and Scroll Saws. Machinists' Tools and Supplies. Lathes on trial. Catalogue mailed on application.
THE SEBASTIAN-MAY CO., 167 W. 2d St.,
CINCINNATI, O.
MONTGOMERY & CO., 105 Fulton St., New York, Gen'l Agents.

TOBIN BRONZE
Tensile Strength upwards of 79,000 lbs. per sq. in.
Torsional Strength equal to the best Machinery Steel.
Anti-Frictional and Non-Corrosive.
CAN BE FORGED HOT.
Rods for pumps and bolts. Yacht shafting. Rolled sheets and plates for pump linings and condenser tube sheets, &c. Ingot metal for car and engine bearings. Spring wire.
ANSONIA BRASS & COPPER CO., Sole Manufacturers.
Send for Circular. CHICAGO. NEW YORK.


SMALL POWER OR HAND PLANER.
FOR ANY SMALL WORK.
Weight of Platen 100 lbs.
A. J. WILKINSON & CO.,
184 Washington St., BOSTON, MASS.
SEND FOR CIRCULAR.

FINE TAPS, DIES, REAMERS, ETC.

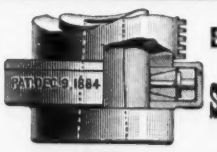
LIGHTNING AND GREEN RIVER SCREW PLATES.
Bolt Cutters, Hand and Power Drilling Machines, Punching Presses, Tire Benders, Tire Upsetters and Other Labor-Saving Tools. Send for Price List.
WILEY & RUSSELL MFG. CO., GREENFIELD, MASS.

Iron Planers from 16" to 36" wide by any length.
H. C. PEASE & CO.,
Worcester, Mass.


PATENT UNIVERSAL DEPTH ANGLE AND SCREW-CUTTING CENTER TWIST DRILL GAUGE.
J. WYKE & CO., Fine Machinists' Tools.—E. Boston, Mass.—Send for Circular.

BABBITT METAL
Cooke & Co.'s Special Brands.
ACME, for high speeds and heavy work.
SUPERIOR, for jobbing and general use.
RELIABLE, for shafting bearings for ordinary service.
Write for prices or send us a sample order.
22 CORTLANDT ST.,
NEW YORK.

Pease Iron Planers.
Following sizes carried in stock:
20 in., 22 in., 24 in., 26 in. & 30 in.
HILL, CLARKE & CO.,
156 OLIVER ST., - BOSTON, MASS.

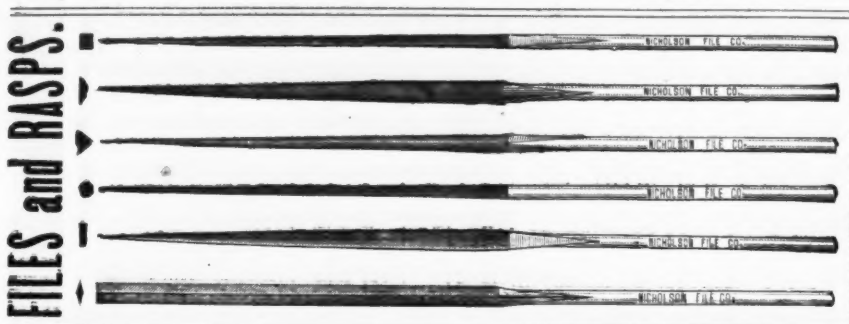


THE BROWNELL ANTI-FRICTION Step or Thrust Bearing
FOR
Lathes, Drills, Worm Shafts of Elevators or Hoists, Jack Screws, Mill Stones, Water Wheel and Propeller Shafts.
Bearings of all sizes made to order, and patent rights for sale by
G. L. BROWNELL,
WORCESTER, MASS.
Correspondence Solicited.

VAN DUZEN'S
STEAM JET PUMP
For MILLS, FACTORIES, SHOPS, ETC.
For Elevating and Conveying Liquids.
For Emptying Pits, Sinks, Cesspools, etc., and as a Fire Pump.
10 Sizes. $7 to $75. Every Pump warranted.
Write for Descriptive Pump Circular, A
VAN DUZEN & TIFT, CINCINNATI, O.

BETTS MACHINE CO.,
WILMINGTON, DEL.

MACHINE TOOL BUILDERS.



FILES and RASPS.

PROVIDENCE, R. I., U. S. A.

CRUCIBLE AND OPEN HEARTH
CAMERON SELF-HARDENING
STEEL

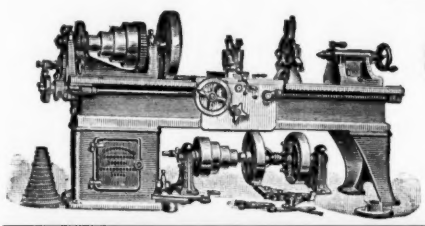
ESTABLISHED 1859.

HOWE, BROWN & CO., L't'd, Mfrs., Pittsburgh, Pa.

BRANCH OFFICES: 12 Cliff St., New York. 127 Oliver St., Boston. 228 Lake St., Chicago.

FOR IMMEDIATE DELIVERY.

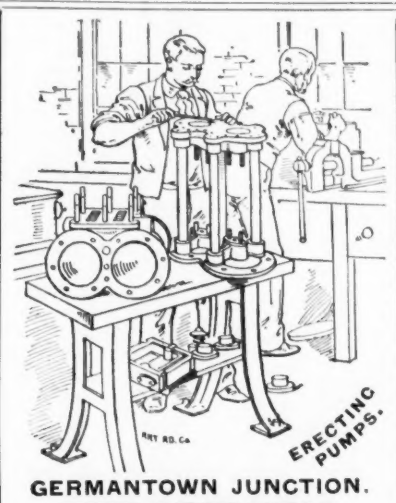
16-20, 20 & 24 Inch ENGINE LATHES,
14 & 16 inch BRASS LATHES,
—AND—
SCREW MACHINES IN LARGE VARIETY.



Bridgeport Machine Tool Works,
E. P. BULLARD, Prop.
BRIDGEPORT, CONN.

Established in 1874.
CLEVELAND TWIST DRILL CO.
Corner Lake & Kirtland Sts., Cleveland, O.
101 Chambers Street, New York.
85 Queen Victoria St., London, Eng.

FITCHBURG MACHINE WORKS,
Manufacturers of
Metal-Working Machinery.
OFFICE AND WORKS
NOS. 13 to 21 MAIN STREET,
FITCHBURG, MASS.
SEND FOR CATALOGUE E.



BARR PUMPING ENGINE CO
GERMANTOWN JUNCTION.
PHILADELPHIA
DUPLEX PUMPS ALL SIZES. EVERY SERVICE

C. W. LE COUNT,
South Norwalk, Conn.

REDUCED PRICE OF LE COUNT'S HEAVY STEEL DOG

No.	Inch.	Price.
1	3-8	$ .40
2	1-2	.50
3	5-8	.60
4	3-4	.60
5	7-8	.70
6	1	.70
7	1 1-8	.80
8	1 1-4	.80
9	1 3-8	.90
10	1 1-2	.95
11	1 3-4	1.10
12	2	1.20
13	2 1-4	1.35
14	2 1-2	1.45
15	3	1.60
16	3 1-2	1.80
17	4	2.10
18	4 1-2	2.75
19	5	4.25
Full set of 19		$23.60
20 (ext.)	5 1-2	4.00
21 (ext.)	6	5.00

This Dog has a Very Heavy Pose, so that if the thread wears a Heavier Screw can be substituted.

Le Count's Heavy Steel Dog.
With Steel Screws, Lathe Made and Hardened.
When ordering, state as above, whether a full set or a set of 12, or small set of 8 of those dogs prefer them to any other make of Dog.

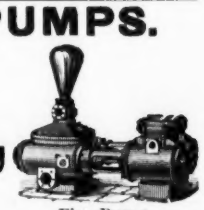
One Small Set of 8—by 1-4 inches to 20 inch, - - - $ 6.25
One Set of 12—by 1-4 in. to 2 in. continued by 1-2 in. to 4 in 13 25

"TWENTY YEARS WITH THE INDICATOR."
[PRAY.] Vols. 1 and 2 (one volume.) Seventh thousand. Large 8vo, 285 pp., many illustrations. Price $2.50. JOHN WILEY & SONS, 15 Astor Place, New York.

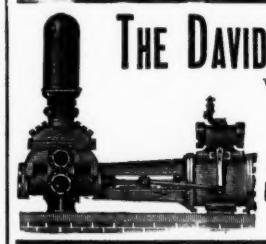
HALL DUPLEX STEAM PUMPS.
Send for 1890 Catalogue.

Boiler and Pump Combined.

HALL STEAM PUMP CO.,
91 Liberty St., New York.



Fire Pump.



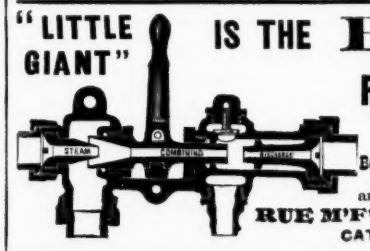
THE DAVIDSON STEAM PUMPS AND PUMPING ENGINES.
WARRANTED THE BEST MADE FOR ALL SITUATIONS.
Manufactured by
M. T. DAVIDSON.
PRINCIPAL OFFICE AND WORKS, 43-53 Keap St., Brooklyn, N. Y.
BRANCH OFFICES: 77 LIBERTY STREET, NEW YORK. 51 OLIVER STREET, BOSTON.

WHY THIS IS PUT HERE!
For the reason that if you are interested in raising water or other liquids by steam power, we wish to call your attention to the
NEW PULSOMETER,
CHEAPEST & BEST STEAM PUMP IN THE MARKET. PRICES LOWER THAN ANY OTHER.
More Efficient, Simple, Durable, and more Economical, both as to running expenses and repairs, than any other Steam Pump.
Call or write for our new 96 page Illustrated Descriptive Book containing Full Particulars, Reduced Net Prices, and hundreds of A 1 Testimonials. Mailed Free.
PULSOMETER STEAM PUMP CO., 120 LIBERTY ST., N. Y.

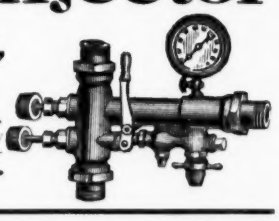
UNIVERSAL RADIAL and RADIAL DRILLING MACHINES
THREE DESIGNS. SIX SIZES
EMBODY ALL DESIRABLE FEATURES
PRICES $450.00 & UPWARD
ADDRESS UNIVERSAL RADIAL DRILL CO
CINCINNATI, O. U.S.A.

WILLIAM JESSOP & SONS, L'D.
MANUFACTORY, SHEFFIELD, ENGLAND.
Chief American Office, 91 JOHN ST., NEW YORK.
JESSOP'S BEST TOOL STEEL
Cold Medal, Paris, 1889.
Importation Orders Promptly filled.
ALL KINDS OF Steel in Stock.

"LITTLE GIANT" IS THE Best Injector



For Feeding all Steam Boilers.
RUE'S EJECTOR,
Superior to all others for Raising and Forcing Water and other Liquids.
Boiler Washer and Testing Device.
Uses Warm Water, avoiding injury and facilitating the Raising of Steam.
RUE M'F'G CO., PHILA., PA.
CATALOGUES FREE.



Root's Force Blast Rotary Blower.
FOR
FOUNDRIES, SMITH SHOPS, PNEUMATIC TUBES, VENTILATION, ETC.

SLOW SPEED, POSITIVE BLAST, PERFECTLY BALANCED.
Best Mechanical Construction.
P. H. & F. M. ROOTS, Manufacturers,
CONNERSVILLE, IND.
S. S. TOWNSEND, Gen. Agt. } 22 Cortlandt St.,
COOKE & CO., Selling Agts. } NEW YORK.
In Writing, Please Mention This Paper.

ALUMINUM, $2 PER POUND.

THE PITTSBURGH REDUCTION COMPANY, 95 Fifth Avenue, Pittsburgh, Pa., U. S. A., offer commercially pure aluminum at the following rates at Pittsburgh, Pa.:

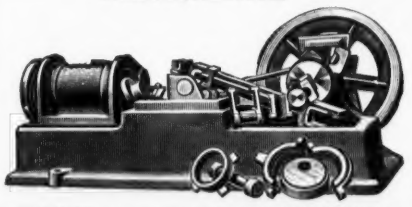
Lots of 1,000 lbs. and over.....$2.00 ℔ lb
Lots of 500 lbs. and over..... 2.25 ℔ lb
Lots of 100 lbs. and over..... 2.50 ℔ lb

Metal guaranteed to be equal in quality to the best metal manufactured by any other process.

Prices on sheets, wire, tubes or castings given upon application.

MACHINISTS' FINE TOOLS.
STANDARD TOOL CO., ATHOL, MASS.
Catalogue and Price List free.

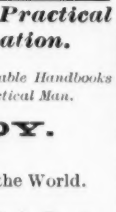
Castings for High Speed Steam Engine.
CYLINDER, 4 in. x 4 1-4 in.



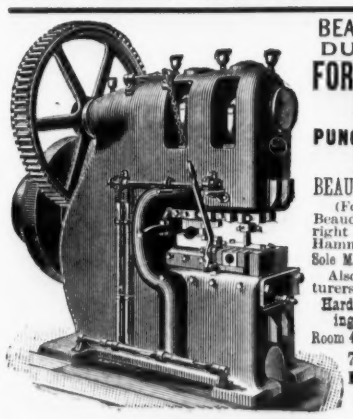
T. SHRIVER & CO., IRON AND BRASS FOUNDERS,
333 E. 56th St., N. Y. City.
Sets of Castings for Engine illustrated above, with *Cast-steel Shaft*, *Connecting Rod* and *Rock Shaft*, and *Brass Bearings*, boxed and delivered on boat or cars, in this city, on receipt of $38.00. This includes a *blue print* of working drawings.

LANSDELL SYPHON
A Cheap & Simple Steam Pump.
Working by direct action of steam. Has no valves or other working parts, and cannot get out of repair, cannot freeze, and will pump ashes, waste, or anything that can enter the pipes.
MADE IN LEAD OR BRASS FOR ACIDS.
J. S. LENG'S SON & CO.,
4 Fletcher Street, NEW YORK.

Maslin's Patent Pulsator Pump.
PAT. FEB. 12, 1889.
Cheapest and Best Automatic Steam Vacuum Pump. Handling DIRTY and GRITTY LIQUIDS without Wear, Oil or Care. Simple, Economical, Efficient & Durable. Pumping Plants for Contractors, Irrigation, Water Works, Railroads, Mining & General Hydraulic Purposes. Write or call for Circulars. JOHN MASLIN & SON, SOLE MANUF'RS, 165-167 1st St., Jersey City, N. J.



BEAUDRY'S DUPLEX FORGING PRESS, PUNCH AND SHEARS.



BEAUDRY & CO.
(Formerly of Beaudry's Upright Power Hammer,)
Sole Manufacturers.
Also Manufacturers of Hard Coal Heating Forges.
Room 4, Mason B'dg.
70 Kilby St., Boston, Mass.

VALUABLE NEW MACHINE WORKS FOR SALE.
ERECTED IN 1889.

Those Valuable New and Extensive Works situated in the city of Hamilton, Canada, on Wentworth street, and adjoining the Grand Trunk Railway. The premises consist of 4 acres of land on which are erected the following, viz.: Moulding shop, 160x60 ft.; Machine shop, 150x60 ft.; Pattern shop, 60x50 ft.; Smith shop, 40x30 ft.; detached engine and boiler house with large substantial brick chimney. The above are all of brick, having immense heavy walls and buttresses. The roofs are specially trussed and stayed for inside heavy service, and are covered with slate. Moulding sand which is shipped to all parts of Canada, lies within a mile of the works. The above works are exempted from taxation for a period of ten years. From the many advantages these works possess, being located in Hamilton, and directly on the line of G. T. Ry., one of the best manufacturing centers in Canada, a grand chance is offered for the carrying on of any large manufacturing business, either engine building, founding, agricultural implement works, or any kind of machine business. Only reason for disposal of the above, poor health of subscriber.

Terms—One-third cash and balance by mortgage for a term of years that may be agreed upon.

All communications to be addressed to

R. McKECHNIE,
DUNDAS, ONT., CANADA.

A Great Repository of Practical and Scientific Information.

One of the Fullest, Freshest, and Most Valuable Handbooks of the Age. Indispensable to Every Practical Man.

NOW READY.
Price $2.00.
Free of Postage to any address in the World.

The Techno-Chemical Receipt Book:

Containing Several Thousand Receipts, covering the Latest, most Important, and most Useful Discoveries in Chemical Technology, and their Practical Application in the Arts and the Industries. Edited chiefly from the German of Drs. Winckler, Elsner, Heintze, Mierzinski, Jacobsen, Koller, and Heinzerling, with additions by William T. Brannt, Graduate of the Royal Agricultural College of Eldena, Prussia, and William H. Wahl, Ph. D. (Heid.), Secretary of the Franklin Institute, Philadelphia, author of "Galvanoplastic Manipulations." Illustrated by 78 engravings, one volume, over 500 pages, 12mo, elegantly bound in scarlet cloth, gilt, closely printed, containing an immense amount and a great variety of matter.

Price $2.00, free of postage to any address in the world.

☞ *A circular of 32 pages, showing the full Table of Contents of this important Book, sent by mail free of postage to any one in any part of the World who will furnish his address.*

HENRY CAREY BAIRD & CO.,
INDUSTRIAL PUBLISHERS, BOOKSELLERS & IMPORTERS
810 Walnut St., Philadelphia, Pa., U. S. A.

PECK'S PAT. DROP PRESS.
NEW HAVEN
BEECHER & PECK, CONN.
DROP FORGINGS OF IRON OR STEEL
BEECHER & PECK, NEW HAVEN CONN.

WORTHINGTON
Independent Condenser
An Economical Addition to Steam Engines.
POWER GAINED or FUEL SAVED
AND
BOILER PRESSURE LOWERED
ESPECIALLY RECOMMENDED FOR
ELECTRIC LIGHT MILL BOAT and PUMPING ENGINES
HENRY R WORTHINGTON
NEW YORK
BOSTON PHILADELPHIA CHICAGO
ST LOUIS ST PAUL SAN FRANCISCO

Facts:—1889 marks the **30th YEAR** of the life of

THE HARRISON SAFETY BOILER.

The results obtained by many of the largest steam users of the country, who have used thousands of horse-power of them during that length of time, will warrant your investigating their merits when in need of power.

HARRISON SAFETY BOILER WORKS,
Germantown Junction, Philadelphia, Pa.

POND ENGINEERING CO.,

CONTRACTING ENGINEERS,

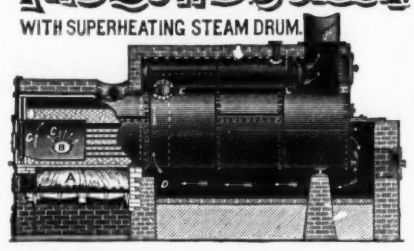
Engines, Boilers, Pumping Engines, Feed Pumps, Feed-water Heaters and Purifiers, Injectors, &c.

Send for ILLUSTRATED CIRCULAR.

St. Louis. Chicago. Kansas City. Omaha.

THE LOWE BOILER

WITH SUPERHEATING STEAM DRUM.



Over fifty years' competition has proved this system of boiler to be the best in every respect. The **LOWE BOILER**, with all improvements, is the simplest, best wearing and most economical of any kind of fuel.

Send for description and histories of Steam Boilers and Feed Water Heaters (free) to

BRIDGEPORT BOILER WORKS,
BRIDGEPORT, CONN.

THOS. H. DALLETT & CO.

1305 Buttonwood Street,
PHILADELPHIA, PA.

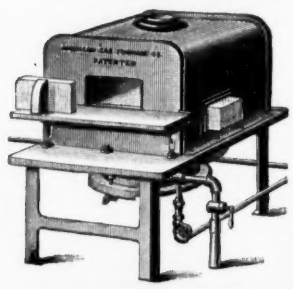
Portable Drills,
Hand Drills,
Boiler Shell Drills,
Light Drill Presses,
Special Machinery.

SEND FOR CATALOGUE.

THE STERLING WATER TUBE BOILERS

Have unusually large steam and water spaces and well-defined circulation. The fire-brick furnace and almost vertical water tubes give remarkable economy of fuel with rapid and steady steaming. Dry steam at any pressure. Large mud drum. First cost moderate. Freedom from leakage and repairs. No cast metal. No hand-holes. Three man-holes give quick access to every part of the boiler.

THE INTERNATIONAL BOILER CO., Ltd.,
74 CORTLANDT STREET, NEW YORK.



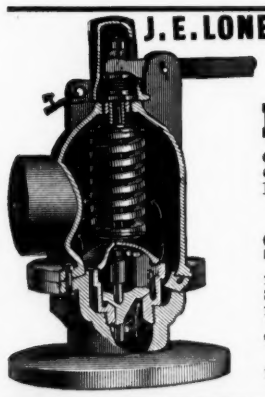
AMERICAN GAS FURNACE CO.,

DESIGNERS AND MANUFACTURERS

GAS BLAST FURNACES.

Send for Catalogue. Estimates made for any mechanical operation requiring **high, even** and **controllable temperature.**

No. 80 NASSAU ST., NEW YORK.



J. E. LONERGAN & CO.

211 Race St., Phila.

Manufacturers of

PATENT OILERS,

Cylinder Sight Feed Cups, Government Regulation

POP SAFETY VALVES

for Locomotive, Stationary and Marine Boilers, also the "Reliable" Steam Trap.

1888 Catalogue free on application.

T. R. ALMOND, 85 Washington St., Brooklyn, N. Y., is prepared to *grant licenses* on moderate terms for the use of his

Patent Loose Pulley Lubricating Device,

illustrated in this paper, Jan. 23, 1890 issue. One tablespoonful of oil will last for months.

BEST SYSTEM on Earth for **PUNCHING** IRON AND STEEL.

OUR **NEW CATALOGUE OF TOOLS**

And Supplies sent free to any address on receipt of Ten Cents in Stamps (for postage).

Chas. A. Strelinger & Co., WOOD AVE. **Detroit, Mich.**

SCROLL SAWS

THE

FLEETWOOD & DEXTER

ARE THE BEST.

THOUSANDS SOLD.

Write for Illustrated Price Lists to

TRUMP BROS. MACH. CO.
Manufacturers.
WILMINGTON, DEL., U. S. A.

UNIVERSAL AND PLAIN
MILLING MACHINES
EXCLUSIVE SPECIALTY
ADDRESS
THE CINCINNATI MILLING MACH'E CO.
CINCINNATI, O.

FRICTION

CLUTCH PULLEYS AND CUT-OFF COUPLINGS

JAS. HUNTER & SON,
North Adams, Mass.

DRAFTSMEN!

If your Stationer does not keep Dixon's American Graphite Artists' Pencils, send 16 cents (mention this paper) and you will receive samples worth double the money.

DIXON'S GRADE STAMPS ARE AS FOLLOWS:

Similar grade to European Stamp of

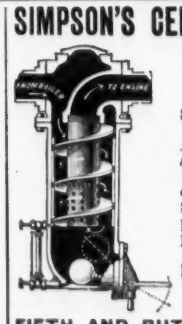
Preferred by many draftsmen to the best imported.

V V S—Very, very soft...(B B B)
V S—Very soft.....(B B)
S—Soft.....(B and No. 1.)
S M—Soft medium.....(H B and No. 2.)
M B—Medium black....(F)
M—Medium.....(H and No. 3.)
M H—Medium hard...(H H)
H—Hard.....(H H H and No. 4.)
V H—Very Hard.....(H H H H and No. 5.)
V V H—Very, very hard (H H H H H H)

JOS. DIXON CRUCIBLE CO.,
JERSEY CITY, N. J.

SIMPSON'S CENTRIFUGAL SEPARATOR

AND TRAP.



For supplying Clean and Dry Steam to Engines, Dryers, Etc. Also *Keystone Feed-Water Heaters and Purifiers, Keystone Belt Pumps, Simpson's Centrifugal Exhaust Heads*, and other Engineering Specialties. Steam Plants furnished complete and erected. Send for particulars.

KEYSTONE ENGINE AND MACHINE WORKS,
FIFTH AND BUTTONWOOD STS., PHILA.
Or, A. T. ARTHUR, Selling Agent, 18 Cortlandt St., N. Y.

WESTCOTT CHUCK CO., Formerly Oneida Steam Engine & Foundry Co., ONEIDA, N. Y.

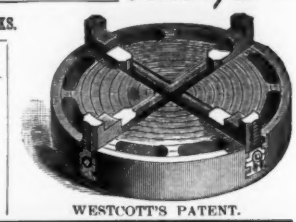
Manufacturers of all kinds of

LATHE AND DRILL CHUCKS

SEND FOR Catalogue.

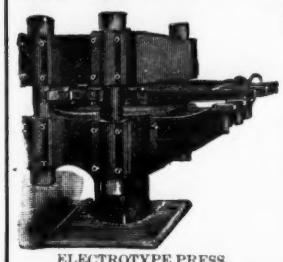
SCROLL COMBINATION LATHE CHUCKS.

Diameter over all.	Will hold inside of Jaws.
4 9-16 in.	5 1-2 in.
6 in.	6 1-2 in.
7 1-2 in.	8 in.
10 1-8 in.	12 in.
13 1-4 in.	15 in.
16 in.	18 in.
18 1-2 in.	21 1-2 in.
21 1-4 in.	26 in.
24 in.	30 in.
30 in.	36 in.
36 in.	43 in.



WESTCOTT'S PATENT.

HYDROSTATIC MACHINERY,



ELECTROTYPE PRESS.

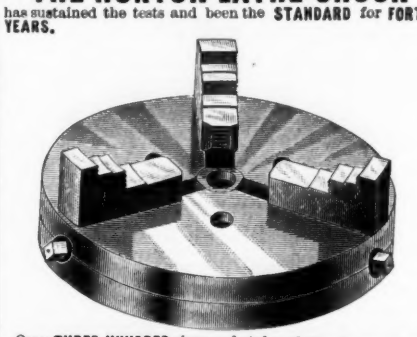
PRESSES,
PUMPS,
PUNCHES,
ACCUMULATORS,
JACKS,
VALVES,
FITTINGS,
&c., &c.

WATSON & STILLMAN,
204-210 E. 43d St., N. Y.

VOLNEY W. MASON & CO.,
Friction Pulleys, Clutches and Elevators,
PROVIDENCE, R. I.

"THE HORTON LATHE CHUCK"

has sustained the tests and been the **STANDARD** for **FORTY YEARS.**



Over **THREE HUNDRED** sizes and styles of Chucks, made and kept in stock, by

THE E. HORTON & SON CO.,
WINDSOR LOCKS, CONN., U. S. A.
SEND FOR ILLUSTRATED PRICE LIST.

UNIVERSAL LEVER SCROLL CHUCKS.

MADE IN 8 SIZES

THIS IS THE FIRST UNIVERSAL CHUCK EVER PLACED ON THE MARKET AND WITH ITS MANY IMPROVEMENTS STANDS TO DAY ON A PAR WITH OTHER CHUCKS OF A MUCH HIGHER COST

MANUFACTURED BY THE CUSHMAN CHUCK CO. HARTFORD, CONN.

SOLD BY ALL DEALERS. SATISFACTION GUARANTEED

SEND FOR NEW DESCRIPTIVE CATALOGUE.

"SWEETLAND" CHUCKS

SEND FOR DISCOUNTS.

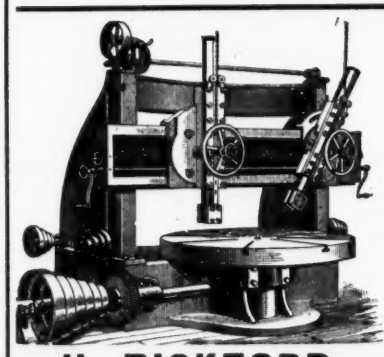
THE HOGGSON & PETTIS MFG. CO.,
Est. 1849. NEW HAVEN, CONN.

INDEPENDENT CHUCKS.

(See AM. MACHINIST, Nov. 5, 1887.)

Before buying Chucks of this class, write us for particulars of our latest improvements. Different from other makes, and we claim several points of superiority which we submit to the judgment of mechanics.

THE D. E. WHITON MACHINE CO.,
NEW LONDON, CONN.
S. A. SMITH, 23 S. Canal St., Chicago, Western Agt.



H. BICKFORD,

LAKE VILLAGE, N. H.

ENGINE AND TURNING MILLS,
4, 5 and 6 Ft. SWING.
BORING AND

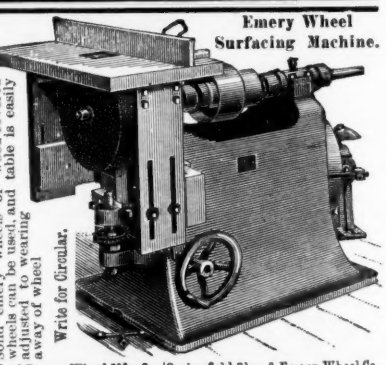
TO BUYERS AND USERS OF MACHINERY.

You will save money and get what you pay for by having us examine machinery and report on the same before buying. Try us and be convinced.

We also make drawings and blue prints, and give **SPECIAL ATTENTION TO THE DESIGNING OF MACHINERY FOR ALL PURPOSES.** Send for Blue Book giving more information.

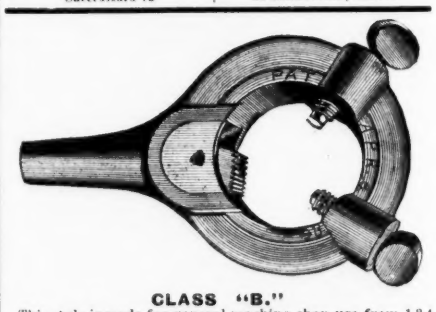
JONES & MACK,
MECHANICAL ENGINEERS,
5 W. 4th Street, Cincinnati, O.

Emery Wheel Surfacing Machine.



Base of machine has sufficient flare to give solid floor foundation. Tube is so supported that it cannot spring under heavy weights. Solid emery wheels or wood-covered wheels can be used, and table is easily adjusted to wearing away of wheel. Write for Circular.

Springfield Emery Wheel Mfg. Co., Successors to Springfield Glue & Emery Wheel Co., SPRINGFIELD, MASS.



CLASS "B."

This style is made for general machine shop use from 1 3-4 in. to 8 in. or larger. Can't slip. No wrench required, and satisfaction guaranteed. Write for catalogue showing the different styles. MANUFACTURED BY

THE MIDDLETOWN (OHIO) MACHINE CO.

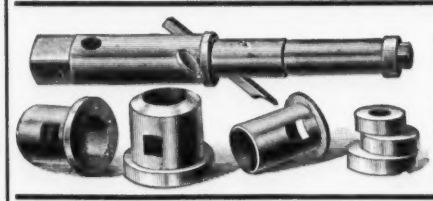
FRISBIE FRICTION PULLEYS AND CLUTCHES.

THE D. FRISBIE CO.,
114 LIBERTY STREET, - NEW YORK

TOOL AGENTS WANTED in every Shop in the United States. Send 10c. for Catalogue, Stationery &c.
THE FINEST OF MECHANICAL TOOLS A SPECIALTY.
C. B. JAMES, 98 Lake St., Chicago, Ill.

— THE —

Vance Lightning Flue Cutter



For removing Flues from Locomotive and Stationary Boilers. One man can cut five hundred (one end) in a day. In use in the leading Railroad Shops of the country. Combination Cutter for removing 2 in., 2 1-4 in., 2 1-2 in. and 3 in. Flues, $50. Sent on approval to Railroad Co.'s. Liberal Discounts to the Trade.

VANCE TUBE CUTTER CO., Geneva, N. Y.

SPRUE CUTTERS. SHEARS. TOGGLE-JOINT DRAWING PRESSES.

STILL IN THE LEAD!

THE ONLY AMERICAN FIRM AWARDED

A GOLD MEDAL AT THE PARIS EXPOSITION 1889.

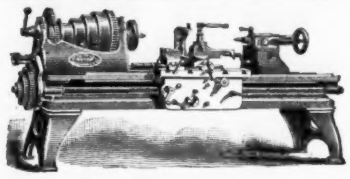
FOR SUPERIORITY IN PRESSES, DROP HAMMERS AND DIES.

THE STILES & PARKER PRESS CO.,
203-207 Centre Street, NEW YORK. MIDDLETOWN, CONN.

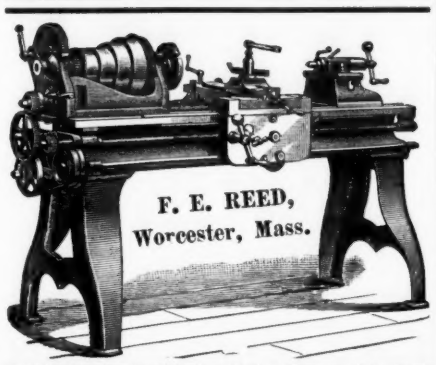
MORSE TWIST DRILL AND MACHINE COMPANY, New Bedford, Mass.
Manufacturers of **Morse Patent Straight-Lip Increase Twist Drills.**

Solid and Shell Reamers, Beach's Patent Self-Centering Chuck, Bit Stock Drills.
DRILL GRINDING MACHINES, MILLING CUTTERS AND SPECIAL TOOLS TO ORDER.

HICKORY BICYCLES
SEND FOR OUR 1890 CATALOGUE.
STERLING ELLIOTT, NEWTON, MASS.

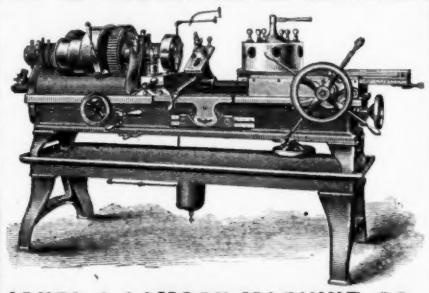


NEW HAVEN MANFG. CO.
NEW HAVEN, CONN.
IRON-WORKING MACHINERY,
Planers, Shapers, Drills, Slotters, Etc.



ENGINE Lathes, Hand Lathes, Foot Lathes, Upright Drills and Milling Machines. Agents, MANNING, MAXWELL & MOORE, 111 LIBERTY STREET, NEW YORK.

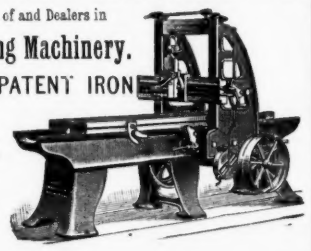
TURRET SCREW MACHINERY.



JONES & LAMSON MACHINE CO.,
SPRINGFIELD, VT.

FLATHER IRON PLANERS.
Beautiful Designs. Accurate Workmanship.
22, 24. 26 and 30 Inch.
HILL, CLARKE & CO.,
General Selling Agents,
156 OLIVER ST., BOSTON, MASS.

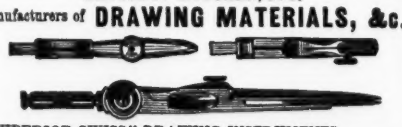
L. W. POND MACHINE CO.
Manufacturers of and Dealers in
Iron Working Machinery.
IMPROVED PATENT IRON PLANERS A SPECIALTY.
152 Union St., WORCESTER, MASS.



COILS & BENDS
— OF —
IRON, BRASS and COPPER
PIPE.
ALL STYLES.
THE NATIONAL PIPE BENDING CO.,
82 River Street, NEW HAVEN, CONN.

GRAY PLANERS.
FOR QUICK DELIVERY.
One 30 in.x30 in.x8 ft.
One 36 in.x36 in.x12 ft., with two heads.
HILL, CLARKE & CO.,
156 OLIVER ST., - BOSTON, MASS.

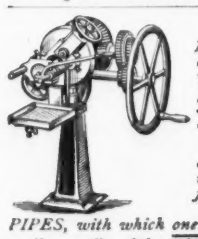
KEUFFEL & ESSER CO., 127 FULTON ST., NEW YORK.
FACTORY: HOBOKEN, N. J.
Manufacturers of **DRAWING MATERIALS, &c.**



SUPERIOR SWISS" DRAWING INSTRUMENTS.
"BEST GERMAN" DRAWING INSTRUMENTS.
PARAGON, DUPLEX, UNIVERSAL, ANVIL Drawing, **HELIOS,** Blue Process Papers, Scales, Triangles, T-squares, Drawing Boards, &c.
FULL CATALOGUE ON APPLICATION.

WILLIAM BARKER & CO.,
Manufacturers of
Iron and Brass Working
MACHINERY,
140 & 142 E. SIXTH ST.,
Near Culvert,
CINCINNATI, O.
Send for Circulars and Prices.

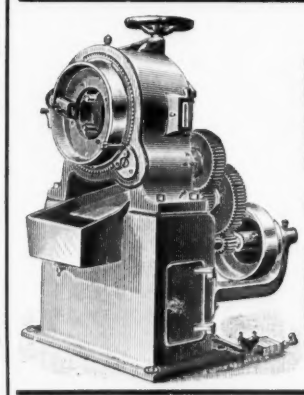
"Eclipse" Hand Pipe-Cutting Machines.



No. 1.—Powerful, inexpensive, simple in construction. Cuts and screws pipes ⅛ to 2-inch. Easily carried about.

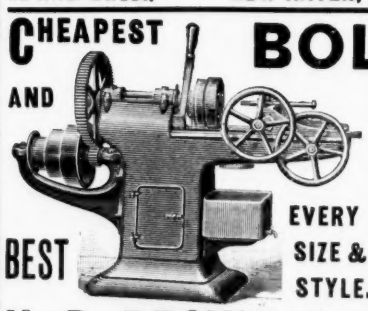
"ECLIPSE" Nos. 2 and 3. These are powerful and most efficient machines for cutting large PIPES, with which one man can easily cut off and thread 6-inch pipe.
No. 2 Cuts and Screws 2½ to 4 in.
No. 3 " " " 2½ to 6 in.
It will pay you to write us for particulars.
PANCOAST & MAULE,
(Mention this paper.) Philadelphia.
We also build Power Machines.

CARY & MOEN CO.
WIRE OF EVERY DESCRIPTION & STEEL SPRINGS. NEW YORK CITY



CURTIS & CURTIS, 66 CARDEN ST., BRIDGEPORT, CONN.
Pipe Cutting and Threading Machinery, FOR HAND OR POWER.
RATCHET DRILLS, RATCHET DIE STOCKS AND MALLEABLE IRON PIPE VISES.

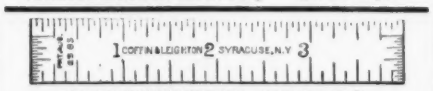
CHEAPEST AND BEST BOLT CUTTERS.



EVERY SIZE & STYLE.
H. B. BROWN & CO.,
EAST HAMPTON, CT.

WIRE STRAIGHTENING AND CUTTING MACHINERY

Can be used in any Hollow Spindle Lathe.
COLLINS-GOODIN MFG. CO., St. Louis, Mo.



MACHINIST'S SCALES,
PATENT END GRADUATION.
We Invite Comparison for Accuracy with all others.
EVERY SCALE GUARANTEED. SEND FOR LIST.
COFFIN & LEIGHTON, SYRACUSE, N. Y.

W. C. YOUNG & CO., Worcester, Mass. Manufacturers of
Engine Lathes, Hand Lathes,
FOOT POWER LATHES, SLIDE RESTS, ETC.

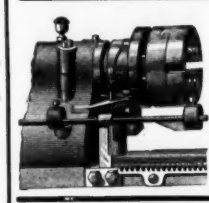
D. SAUNDERS' SONS, Yonkers, N. Y.
MANUFACTURERS OF
Steam & Gas Fitters' Hand Tools.
SEND FOR CIRCULAR.

Pipe Cutting THREADING, AND Tapping Machines.

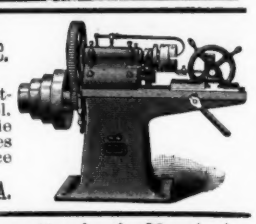
THE PATENT WHEEL PIPE CUTTER shown in the cut combines simplicity with strength and lightness. Easily adapted to various sizes of pipe. Rolling instead of sliding motion. No loose parts to become detached and mislaid. All wearing surfaces are of tool steel hardened. Less friction of parts than any other pipe-cutter made.

BUFFALO BLOWERS
FOR CUPOLAS, FORGES, FURNACES &C. EXHAUSTERS, STEAM FANS HEATERS & VENTILATING WHEELS
BUFFALO FORGE CO. BUFFALO, N.Y.

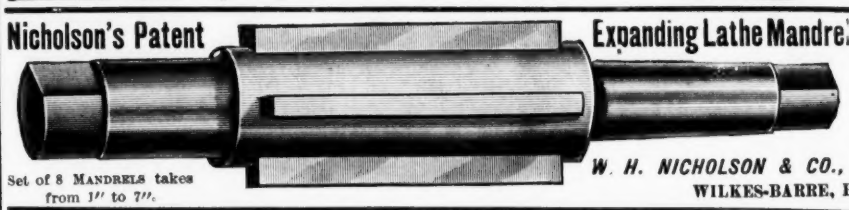
ADAMS
Automatic Bolt-Threading & Nut Tapping Machine.
Made in all Sizes to Cut from 1-4″ to 6″.



The simplest and most durable machine in existence. The threading head is made entirely of steel. No links, levers, springs, caps, cases, blocks or die rings in or about the head. Separate Heads and Dies Furnished. Write for descriptive circular and price list to
Capitol Mfg. Co., Rees St. near Halsted, Chicago, Ill., U. S. A.



Nicholson's Patent Expanding Lathe Mandrels.



Set of 8 MANDRELS takes from 1″ to 7″.
W. H. NICHOLSON & CO.,
WILKES-BARRE, PA.

BLAISDELL ENGINE LATHES.
Great Variety of Styles and Sizes on Hand.
AND ALSO
NEW PATTERN UPRIGHT DRILLS.
HILL, CLARKE & CO.,
156 OLIVER ST., BOSTON, MASS.

Something New! One, two, three, and four spindle drills for light work.

DRILLS

The most useful patented improvement in drill presses for years is applied.

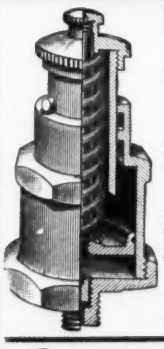
SENSITIVE

Spindles driven with single, endless belts. Large driving pulleys, tightener and variable speeds provided.

Over 1,000 in use. Buy the **latest** and **best.** Special machinery to order. Catalogue of fine tools free.

Dwight Slate Machine Co.
HARTFORD, CONN.

PATENTS THOMAS P. SIMPSON, Washington, D. C No atty's fee until Patent obtained. Write for Inventor's Guide.



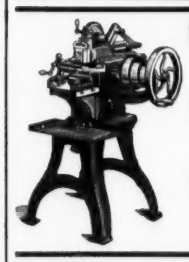
LACKAWANNA GREASE CUP
Will Save Its Cost In Oil alone Several Times per Annum.
SAVES ALSO IN LABOR, AND COST OF COTTON-WASTE. PREVENTS DRIPPING AND SPATTERING.
A POSITIVE FORCE FEED with the most PERFECT REGULATION and GREATEST CONVENIENCE in operation yet attained in any device for the lubrication of machinery. Works equally well in every possible position
Lackawanna Lubricating Co.,
41 Coal Exchange, Scranton, Pa.

MACHINERY For Reducing and Pointing Wire.
ESPECIALLY ADAPTED TO POINTING WIRE RODS AND WIRE FOR DRAWING.
For Machines or Information, address the Manufacturer,
S. W. GOODYEAR, Waterbury, Ct.

BARNES' PATENT UPRIGHT DRILLS.

20 to 42 inch swing, with both worm, and lever feed, self-feed and back-geared.
Barnes' Patent Friction Driver. Sensitive Drill. Single and Multiple Spindle.
Barnes' Patent Engine Lathe.
15 inch swing, 6 foot or 8 foot bed.
They have advantages not found in other machines in this line. It will pay parties desiring to purchase or know more about these machines to send for full description and prices to
W. F. & JOHN BARNES CO.,
ROCKFORD, ILL.
Address No. 1995 Ruby St.

SEND STAMP FOR FULL LIST.



BOYNTON & PLUMMER,
WORCESTER, MASS.
Manufacturers of
Shaping Machines,
Drilling Machines,
Bolt Cutting Machines.
Send for Catalogue.

HUGO BILGRAM,
440 N. 12th St., Phila., Pa.
Maker of all kinds of
MACHINERY.
Special facilities for Accurate Work.
Bevel Gears cut theoretically Correct.

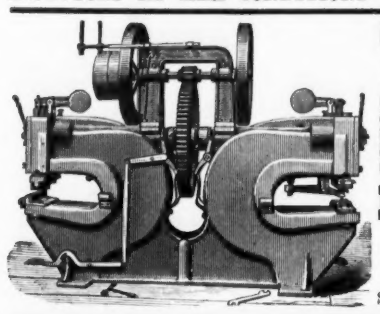
PLANER VISES.
THE GILKERSON MACHINE CO.,
HOMER, N. Y.

A NEW INVENTION.
SURE GRIP STEEL TACKLE BLOCK.
HALF THE COST of hoisting saved to Machinists, Contractors, Butchers, Builders and others. Admitted to be the greatest improvement EVER made in Tackle Blocks. The cheapest in the market. *Write for Catalogue.*
FULTON IRON & ENGINE WORKS,
29 BRUSH STREET,
Established 1852. DETROIT, MICH.

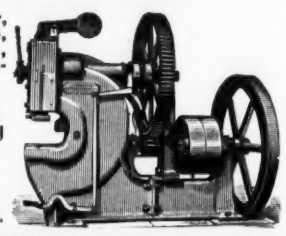
DAMPER REGULATORS.

Our Steam Damper Regulator is the most perfect and simplest machine in the market. Price, $60 and $100. Any one can apply it. Send for circular to Mason Regulator Co., Boston.

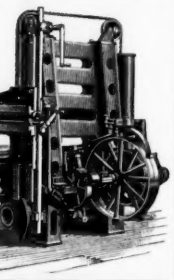
WILLIAM SELLERS & CO., Incorporated.
PHILADELPHIA, PA.
BUILDERS OF
MACHINE TOOLS FOR WORKING IRON AND STEEL,
Improved TURNTABLES for LOCOMOTIVES, CARS and PIVOT BRIDGES.
High Speed Power Traveling Cranes and Hand or Power Swing Cranes, Shafting, Pulleys, Hangers, &c., for transmission of power. Improved Self-Adjusting Injector of 1876. Self-Acting Injector of 1887. Fixed-Nozzle Automatic Injector of 1885.
INJECTORS for ALL CONDITIONS of LOCOMOTIVE and STATIONARY SERVICE.



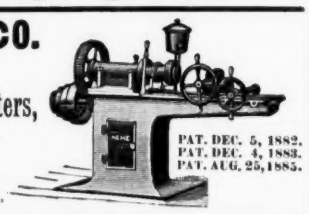
THE LONG & ALLSTATTER CO. Hamilton OHIO.
Double, Single, Angle-Bar, Gang, Horizontal, Twin, Boiler, Spacing, Gate, Multiple, Belt and Steam-Driven
Punches and Shears,
OVER 300 SIZES.
ALSO
Power Cushioned Hammer.
Send for New Catalogue.



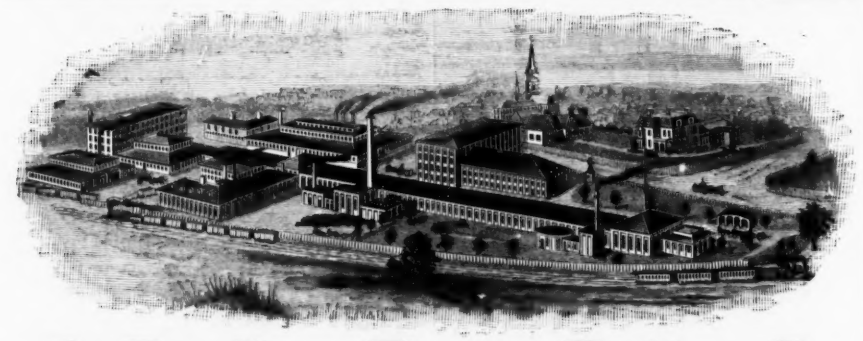
THE OPEN-SIDE IRON PLANERS
STANDARD OPEN-SIDE PLANER, Sizes 30″, 36″, 48″, 60″, by any desired length.
OPEN-SIDE EXTENSION PLANERS, Sizes 72″ wide x 48″ high x 10′ long, up to 120″ wide x 72″ high x 20′ long.
Open-Side Frog and Switch Planers.
Extra Heavy and Powerfully Geared Up.
The DETRICK & HARVEY MACHINE CO.
BALTIMORE, MD.



ACME MACHINERY CO.
CLEVELAND, OHIO.
Manufacturers of "ACME"
Single & Double Automatic Boltcutters,
Cutting from 3-8 in. to 6 in. diameter.
Also SEPARATE HEADS and DIES.
Send for Catalogues and Discounts.
FIRST PREMIUM, CINCINNATI CENTENNIAL.



BRICK MACHINERY ALSO **TILE MACHINERY** Full FACTORY OUTFITS
CAPACITY 10 to 100,000 PER DAY.
8 Different KINDS BRICK MACHINES
THE LATEST and BEST.
PUG Mills, Dump Cars, CLAY Crushers ETC. ETC.
SEND FOR CATALOGUE.
THE FREY, SHECKLER COMPANY, BUCYRUS, O., U.S.A.



The Corliss Steam Engine Co.
PROVIDENCE, R.I.
Incorporated June, 1856; Established by
GEORGE H. CORLISS,
INVENTOR OF THE CELEBRATED
"CORLISS ENGINE."
DESIGNER & BUILDER OF THE FAMOUS
"CENTENNIAL ENGINE,"
Exhibited at the Philadelphia Exposition, 1876.

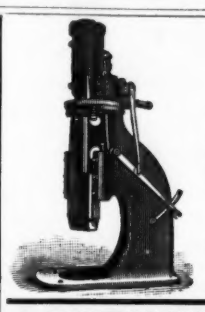
These works have been fully equipped, at great cost, with heavy special tools, of his invention, for them anufacture of this perfected engine, which is a guarantee of superiority in workmanship, and interchangeability of parts never before attempted in the line of steam machinery.

The public will understand that we have no relations with American or European builders of so-called "Improved Corliss Engines," and that the final and perfected Engine of Mr. George H. Corliss, embodying his latest ideas, is to be obtained exclusively at our works.

ALSO MANUFACTURERS OF THE

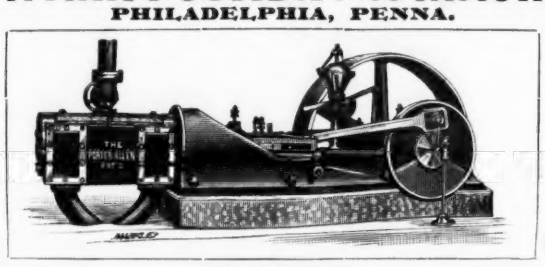
CORLISS PATENT VERTICAL TUBULAR WATER LEG BOILER,

Especially adapted for compound and triple expansion engines requiring superheated steam and at very high pressure.



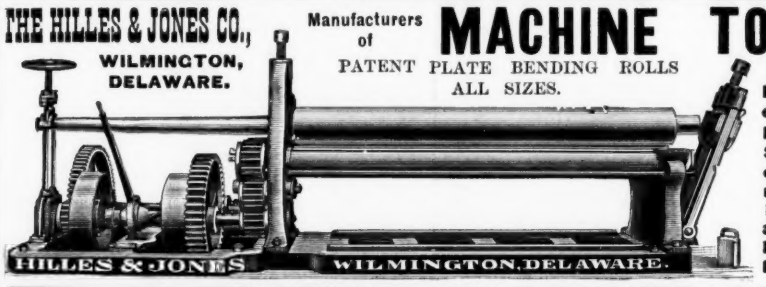
BEMENT, MILES & CO.,
PHILADELPHIA, PA.
—BUILDERS OF—
METAL-WORKING MACHINE TOOLS
FOR
Railroad Shops, Locomotive and Car Builders, Machine Shops, Rolling Mills, Steam Forges, Ship Yards, Boiler Shops, Bridge Works, Etc., Etc.

SOUTHWARK FOUNDRY & MACHINE CO.,
PHILADELPHIA, PENNA.
BOILERS. TANKS. STEAM HAMMERS. HEAVY CASTINGS.



BLOWING AND REVERSING ENGINES. CENTRIFUGAL PUMPS. STEAM PUMPS
SOLE MAKERS OF
PORTER-ALLEN AUTOMATIC ENGINE.
HIGH ECONOMY. DURABILITY. CLOSE REGULATION.

THE HILLES & JONES CO.,
WILMINGTON, DELAWARE.
Manufacturers of **MACHINE TOOLS.**
PATENT PLATE BENDING ROLLS ALL SIZES.
FOR Boiler Makers, Bridge Builders, Ship Builders, Railroad Shops, Locomotive and Car Builders, Etc., Etc.

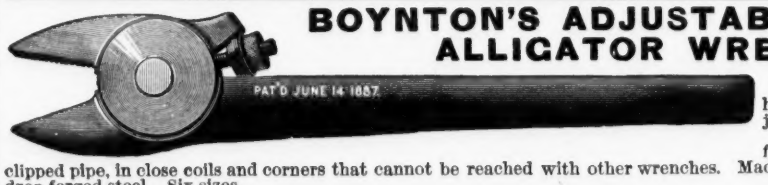


CASTINGS
Rough and finished to order. All kinds of castings in green or dry sand and loam. Large variety of gear and pulley patterns. Soft castings for finishing. *Patterns made to order.* Parties requiring work are invited to correspond with us before buying elsewhere. Estimates submitted on application.
THE ALLENTOWN FOUNDRY & MACHINE CO.,
3RD and WALNUT STS., ALLENTOWN, PA.

STEEL CASTINGS
FROM 1-4 TO 15,000 LBS. WEIGHT.
True to pattern, sound, solid, free from blow-holes and of unequaled strength.
Stronger and more durable than iron forgings in any position or for any service whatever.
60,000 CRANK SHAFTS and 50,000 GEAR WHEELS of this steel now running prove this.
Crossheads, Rockers, Piston Heads, etc., for Locomotives.
STEEL CASTINGS of every description.
Send for Circulars and prices to
CHESTER STEEL CASTINGS CO.,
Works, Chester, Pa. Office 407 Library St., Philadelphia, Pa.

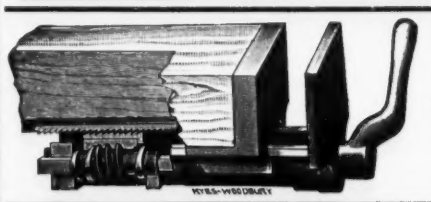
THE AERATED FUEL COMPANY,
425 Main Street, SPRINGFIELD, MASS. J. H. BULLARD, Manager.
FORGING AND WELDING BY PETROLEUM AIR BLAST.
ALL OIL BELOW BURNERS! NO SMOKE, DIRT, OR ASHES!
Represented by WILLIAM PICKETT, SON & CO., 170 Lake St., Chicago; W. S. COLLINS, 171 Broadway, New York. CHILION JONES, Gananoque, Can. G. M. SMITH, Los Angeles, Cal. KALAMAZOO SPRING AND AXLE CO., Kalamazoo, Mich. C. S. BARROWS, 46 Wade Building, Cleveland, Ohio. GILBERT & BARKER MFG. CO., General Agents for the United States, Springfield, New York and Boston.
Sept. 29, 1885. July 5, 1887. Feb. 5, 1889. July 23, 1889.
We will replace in Stock or Mutual Companies any Insurance canceled on account of using this System, when installed according to our plans.

BOYNTON'S ADJUSTABLE ALLIGATOR WRENCH.



Quick and handy in adjustment. Invaluable for work on clipped pipe, in close coils and corners that cannot be reached with other wrenches. Made entirely of drop forged steel. Six sizes.
CAMPBELL PRINTING PRESS AND MFG. CO., MFRS.
160 WILLIAM ST., NEW YORK. 325 DEARBORN ST., CHICAGO.

THE CHESTER FOUNDRY & MACHINE CO.,
CHESTER, PA.
Builders of **CRANES** of every type and capacity, **MARINE, PUMPING** and **BLOWING ENGINES, CORLISS ENGINES, HYDRAULIC PRESSES, ACCUMULATORS,** and **SPECIAL MACHINERY** of every description. **CASTINGS IN DRY OR GREEN SAND AND LOAM.**



QUICK-ACTION VISES,
For Pattern Makers and Wood Workers.
WYMAN & GORDON,
WORCESTER, MASS.
DROP FORGINGS.

BALL AUTOMATIC CUT-OFF ENGINES,
ERIE, PA.
The characteristics of these Engines are Beauty of Design, Superior Finish, Limited Feet in Space required, Economy of Fuel, Perfection of Regulation.
CHARLES R. VINCENT & CO.,
NEW YORK SELLING OFFICE, 15 CORTLANDT STREET.

NEW TANGYE BUCKEYE AUTOMATIC CUT-OFF ENGINES.

In Use, Over 2,500.

25 to 1,000 H. P.

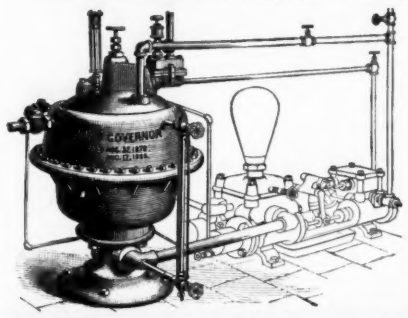
These engines are the combined result of long experience with automatic cut-off regulation, and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds. Highest attainable Economy in Steam Consumption and superior regulation guaranteed. Self-contained Automatic Cut-off Engines 12 to 100 H. P. for driving Dynamo Machines *a specialty*. Illustrated Circulars, with various data as to practical Steam Engine Construction and performance, free by mail. **Address, BUCKEYE ENGIN. CO., Salem, Ohio.**

SALES AGENTS: **W. L. SIMPSON,** 10 TELEPHONE BUILDING, } N. W. ROBINSON, 154 Washington St., Chicago, Ills.
18 CORTLANDT STREET, N. Y. } ROBINSON & CARY, St. Paul, Minn.

KENSINGTON ENGINE WORKS, LIMITED, PHILADELPHIA.

Sole Licensees and Manufacturers for New Jersey (South of Trenton), Eastern Pennsylvania, Delaware, Maryland and Virginia.

BLESSING'S PUMP GOVERNOR.



For use in returning the water of condensation to steam boilers under special circumstances, as where the pressure in heating systems is greatly reduced below boiler pressure, or where sufficient head room is lacking. Is used in connection with a steam pump, so controlling the action of the pump that its piston speed is at all times exactly proportionate to the varying quantity of water to be returned. No stuffing boxes are used in its construction, and friction is reduced to a minimum. Can be adapted to suit a wide range of conditions.

Send for circular of **Blessing's Albany Steam Trap, Blessing's Water Circulator and Purifier, and Blessing's Renewable-Seat Stop and Check Valves.**

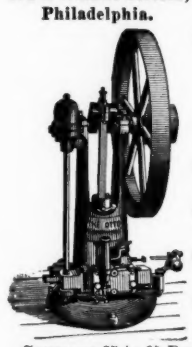
ALBANY STEAM TRAP CO., Albany, N. Y.

"OTTO" GAS ENGINE WORKS.

SCHLEICHER, SCHUMM & CO.,

33d & Walnut Streets, Philadelphia. 151 Monroe Street, Chicago.

New York Agency, 18 Vesey St.



OVER 25,000 ENGINES SOLD.

HORIZONTAL "Otto" Gas Engines.
VERTICAL "Otto" Gas Engines.
TWIN CYLINDER "Otto" Gas Engines.
COMBINED "OTTO" GAS ENGINES AND PUMPS.
COMBINED "OTTO" GAS ENGINES AND DYNAMOS.

Consume 25 to 75 Per Cent. Less Gas than ANY other Gas Engine doing the same work.

MACHINERY DESIGNED. CONOVER & CO CONSULTING & MECHANICAL ENGINEERS 95 LIBERTY ST. N. Y. WORKING DRAWINGS.

STEAM HEATING.

Barnard's Condensing System will accomplish the following desirable features:

Saves Coal, Perfects the Circulation, Prevents all Noise, Prevents Freezing, Uses Exhaust Steam if any, without back pressure, will work at any pressure of steam, high or low. Has no Machinery needing care. Is adapted to Private Houses, Flats Office Buildings, Hotels, Factories, etc.

GEO. A. BARNARD,

No. 15 Cortlandt St., NEW YORK

MACHINERY ON HAND.

9-in. and 12-in. Crank Shaper, H. & P. Good order.
15-in. Friction Shaper, Hendey. "
22 and 15-in. Crank Shaper, Juengst. New.
16-in. Crank Shaper, G. & E. New.
24-in. Shaper, Bridgeport. New.
22-in. stroke Trav. Head Shaper. New.
22 in. x 5 ft. Planer, Wheeler. New.
24 in. x 6 ft. " Powell. New.
26 in. x 8 ft. " Pond. Good.
30 in. x 8 ft. " H. & P. New.
7 and 11 in. swing Hand Lathes, for brass. New.
11 x 5 ft. and 14 x 6 ft. Engine Lathes, Prentiss.
16 x 8 ft. " " "
14, 16 and 18 in. " " Blaisdell.
14 and 16 in. x 6 and 7 ft. " " Bogert.
16 in. x 6 and 8 ft. Engine Lathe, McMahon. New.
18 in. x 8 and 10 ft. " " "
20 in. x 8, 10 and 12 ft. Engine Lathe, McMahon.
16, 20, 20 and 24 in. Engine Lathe, Bridgeport.
20 in. x 12 ft. Engine Lathe, Morse. A1.
20 in. x 8 ft. " " W., L. & Co. Good.
20 in. x 14 ft. " " Wright. New.
28 in. x 14 ft. " " F. & S. New.
32 in. x 16 ft. " " F. & S. New.
26 in. x 50 in. Pulley Lathe, Stevens. Good.
No. 2 Screw Machine, Brown & Sharpe. Good.
No. 1 and 2 Slate Sensitive Drill. New.
2, 3 and 4 Spindle Drills, Slate. New.
20, 22, 23, 25, 28 and 32 in. Drills. New.
Ames Index Milling Machine. Fair.
No. 3 National Bolt Cutter. New.

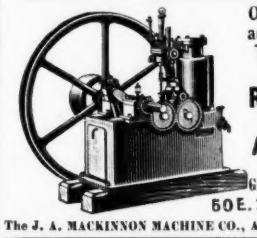
Cold Rolled Shafting in stock, all sizes.

Full line of new Machinery. Write for what you want.
Send for our list of new and second hand tools for sale.

E. P. BULLARD,

72 Warren St., and 62 College Place, New York.

VAN DUZEN GAS & GASOLINE ENGINE



OPERATED with COAL and OTHER MANUFACTURED GASES AND GASOLINE.

RELIABLE AND ECONOMICAL.

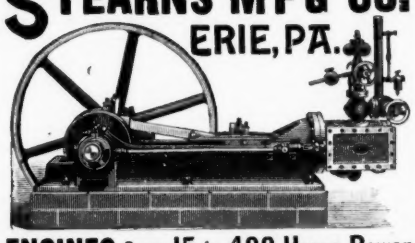
Fully Warranted

VAN DUZEN Gas & Gasoline Engine Co. 50 E. 2d St., Cincinnati, O.

The J. A. MACKINNON MACHINE CO., Agents, 22 Warren St., N. Y.

STEARNS M'F'G CO.

ERIE, PA.



ENGINES from 15 to 400 Horse Power

Boilers of Steel and Iron supplied to the trade or the user. Send for Catalogue.

SAW MILLS and GENERAL MACHINERY

NEW YORK STORE, 46 Cortlandt St.

BRAINARD MILLING MACHINES,

25 Different Styles and Sizes.

HILL, CLARKE & CO.,

General Selling Agents,

156 OLIVER ST., BOSTON, MASS.

NEW AND IMPROVED MILLING MACHINE.

☞ Note the following new features:
☞ Overhanging arm removed without taking off the sleeve.
☞ Sleeve for the overhanging arm and the column cast in one piece.
☞ All movements operated from front of machine instead of under the table.
☞ Long bearings. Long and wide tables.
☞ Power feed entire length of table.
☞ Large spindles, hollow their entire length.
☞ Indexed feeds on all machines.
☞ Large cones, wide belts.
☞ Each machine furnished with a vise.
☞ Built either plain, back geared or universal.
☞ Write for prices, with cuts and full descriptions.

— THE —

LODGE & DAVIS MACHINE TOOL CO.,

CINCINNATI, OHIO.

EASTERN HOUSE:

64 CORTLANDT STREET,

NEW YORK.

WESTERN HOUSE:

68 & 70 SOUTH CANAL ST.,

CHICAGO

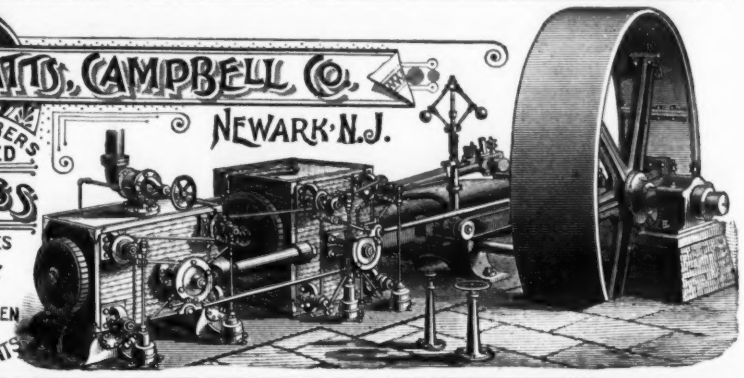
See advertisement, page 16.

THE WATTS, CAMPBELL CO.

NEWARK, N.J.

MANUFACTURERS OF IMPROVED CORLISS STEAM ENGINES IN FULL VARIETY.

CONTRACTS TAKEN FOR COMPLETE POWER PLANTS



Eclipse Corliss Engine.

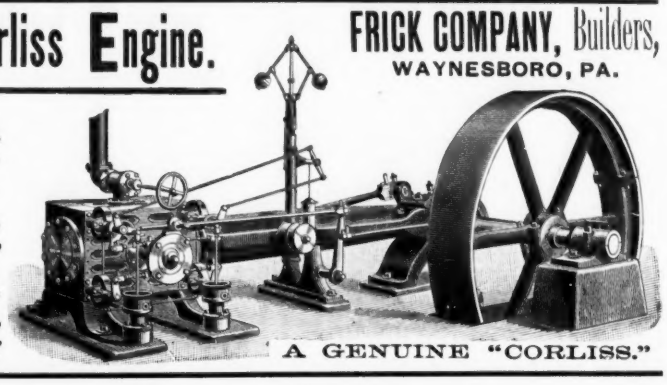
FRICK COMPANY, Builders, WAYNESBORO, PA.

NON-CONDENSING, CONDENSING COMPOUND. 40 TO 1,000 H.P.

Send for Circulars.

E. P. HAMPSON & CO., 36 CORTLANDT ST., *NEW YORK,* Sole Eastern Agents.

JOHN J. METZGER, 69 S. Clinton St., Chicago, WESTERN AGENT.

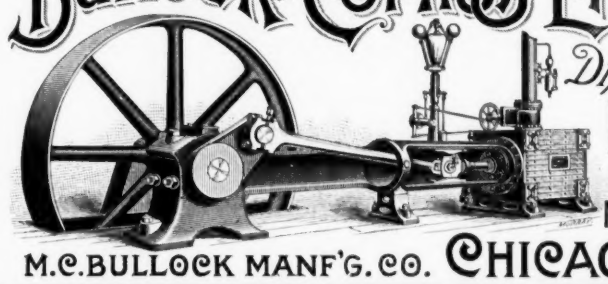


A GENUINE "CORLISS."

Bullock-Corliss Engines.

DIAMOND DRILLS — FOR — PROSPECTING.

BAND FRICTION HOISTS, MINING MACHINERY.



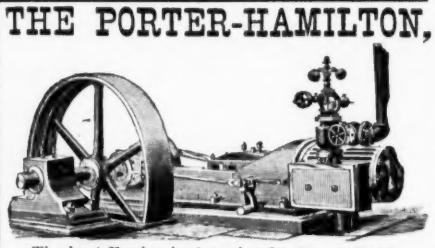
M. C. BULLOCK MANF'G. CO. CHICAGO, U. S. A.

SEND FOR CATALOGUE.

WORCESTER MACHINE SCREW CO.

Manufacturers of Set, Cap & Machine Screws, Studs, etc.

THE PORTER-HAMILTON,



The best Engine in America for Heavy Work.

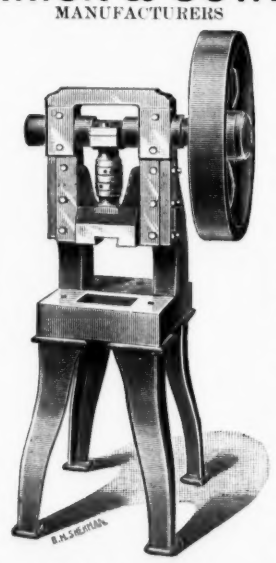
WILLIAM TOD & CO.,

Youngstown, Ohio.

HERRICK & COWELL,

MANUFACTURERS

Drill Presses, Power and Foot Presses.



Emery Wheel Machinery, Paper Box and Special Machinery.

NEW HAVEN, - CONN.

SEND FOR CATALOGUE.

C. H. DE LAMATER & CO.

have closed their extensive manufactory at the **Foot of West 13th Street, New York,** and have sold the Hot Air Pumping Engine and Steam Pump business to the De Lamater Iron Works (incorporated in 1889), and the Propeller Wheel business to the Samuel L. Moore & Sons Co., of Elizabethport, New Jersey.

In order to close out the remainder of the stock, offer for sale

A Very Desirable Lot of Machinery,

such as lathes from 15" to 88" swing, planing machines 48"x45"x10', 53"x50"x12', 17"x14"x24', 72"x69"x24', and various other sizes; drilling machines, slotting machines, shaping machines, boring machines, bolt-cutting machines, cutting-off machines, nut tappers, milling machines, gear cutters, emery tool grinders, portable drills, screw-cutting machines, vises, lathe and planer tools, and a variety of small tools; also traveling and jib cranes.

Punching and shearing machines for boiler makers, with a general outfit of small tools. Blacksmiths' tools, such as anvils, sledges, tongs, etc. Pattern lathes, benches, saws, screws, nails, and a general supply of small tools. Foundry cranes, cupolas and small tools. Blocks, ropes, bolts, nuts, washers, packings, pipe and fittings, iron and brass valves. Boiler iron, steel plate and boiler rivets. Bar iron and steel, also steam hammers, and two 8"x16" and one 10"x20" Rider cut-off engines.

J. A. FAY & CO. CINCINNATI, OHIO, U.S.A.

BUILDERS OF IMPROVED

WOOD-WORKING MACHINERY

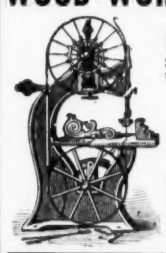
Embraces nearly 400 Machines for

PLANING & MATCHING

Surfacing, Moulding, Tenoning, Mortising, Boring, and Shaping, etc.

Variety and Universal

WOOD WORKERS.



Band, Scroll and Circular Saws, Resawing Machines, Spoke and Wheel Machinery, Shafting, Pulleys, etc. All of the highest standard of excellence.

W. H. DOANE, Pres. D. L. LYON, Sec'y.

NEW AND SECOND-HAND

MACHINERY.

FOR IMMEDIATE DELIVERY.

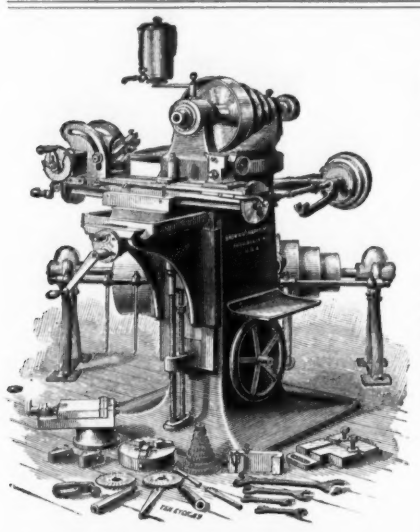
Engine Lathes,	14 in. x 6 ft.	Fitchburg,	new
" "	15 in. x 6-8 ft.	Porter,	new
" "	16 in. x 6 ft.	Fitchburg, 2nd hand	A1
" "	16 in. x 6 ft.	"	new
" "	16 in. x 6 ft.	Wright,	new
" "	16 in. x 6-8-10 ft.	Hendey	new
" "	ditto, with taper,	"	new
" "	18 in. x 8-10 ft.	"	new
" "	ditto, with taper,	"	new
" "	18 in. x 8 ft.	Fitchburg,	new
" "	20 in. x 10 ft.	Wright,	new
" "	21 in. x 8-10 ft.	Fitchburg, 2nd hand,	A1
" "	24 in. x 12 ft.	"	new
" "	60 in. x 20	Gap Bed,	good order
" "	86 in. x 18 ft.	heavy pattern,	good
Drills,	20 in. wheel feed	Prentice,	new
"	21 in. " Back gears,	"	new
"	25 in. Self feed, Back gears,	"	new
"	32 in. " "	"	new
Shapers,	14 in. Traveling Head,	Fitchburg, 2nd hand,	A1
"	24 in. Friction	Hendey, 2nd hand,	A1
"	26 in. Rack,	Lodge, Davis,	new
Planers,	24 in. x 24 in. x 6 ft.	Fitchburg,	new
"	24 in. x 24 in. x 6 ft.	Lathe & Morse,	new
"	24 in. x 24 in. x 6 ft.	W. L. & Co.,	good order
"	30 in. x 26 in. x 10 ft.	Putnam,	"
"	42 in. x 42 in. x 12 ft.	Fitchburg, 2nd hand,	A1
Screw Machines,	No. 1, Complete,	B. & S.	"
"	" " 3, "	"	"
"	" " 2, "	J. & L.	"
Turret Chucking Lathes,	15 in	Hendey,	new
" "	20 in.	"	new
Bolt and Pipe Cutter Combined	2 in.		new
Bement	60 in. Hor. Boring Mill,		A1 order
Niles	36 in. Pulley Machine,		"
Miller, heavy pattern,	12 in. x 4 ft.	Eynon,	new
Bridge Riveter and Compressor,		Allen,	2nd hand
Boiler Rolls, Power,	6 ft.		A1 order

Also full line of **BRIDGE AND BOILER TOOLS.**

Agent for **HALSEY PORTABLE DRILLS,** and **FITCHBURG MACHINE WORKS.**

J. J. McCABE,

68 CORTLANDT ST., NEW YORK.



No. 1 Universal Milling Machine.
Made with and without overhanging arm.

THE ORIGINAL

Universal Milling Machines

Made by the

BROWN & SHARPE MFG. CO.,

PROVIDENCE, R. I.,

Are kept in stock and sold at favorable prices, compared with any of their *IMITATIONS.* By making these Machines in large numbers, with expensive special tools, much greater accuracy has been attained than can be reached by the usual methods of manufacture. The importance of the greatest attainable accuracy in *TOOL-MAKING MACHINES* will be appreciated by Machinists.

Correspondence Solicited. Catalogue Mailed on Application.

WESTERN REPRESENTATIVE,

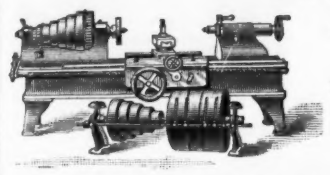
S. A. SMITH,

No. 23 SOUTH CANAL STREET,

CHICAGO, ILL.

THE PRATT & WHITNEY CO.,

HARTFORD, CONN.



Manufacture **LATHES** of Various Sizes

AND OF THE FOLLOWING KINDS:

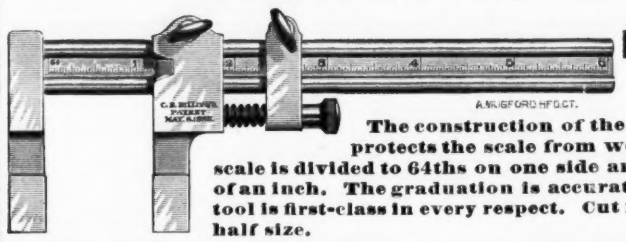
Hand, Engine for Turning and Screw Cutting, Cutting Off, Gap Bed, Pulley Turning and Boring, Turret-Head Engine and Chucking, Hand Wheel Rim Turning, Spinning, Grinding, Pattern Making, &c.

☞ PRICE LIST AND DISCOUNT SHEET SENT UPON APPLICATION.

WESTERN BRANCH, 100 West Washington Street, Chicago, Ills.

THE BILLINGS & SPENCER CO.,

HARTFORD, CONN., U. S. A.



MANUFACTURERS OF

BILLINGS' PATENT BEAM CALIPER.

The construction of the Caliper is such that it protects the scale from wear and abrasion. The scale is divided to 64ths on one side and the other to 100ths of an inch. The graduation is accurate and the finish of the tool is first-class in every respect. Cut represents Caliper one-half size.

Drop Forgings of Bronze, Copper, Iron and Steel of all descriptions.

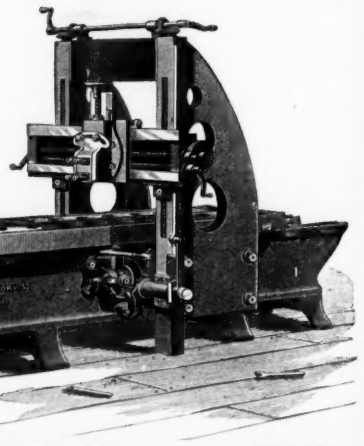
NILES TOOL WORKS,

HAMILTON, OHIO.

PLANERS A SPECIALTY.

New Patterns 1889.

Strictly first class. Moderate prices. Perfection of workmanship. Positive feed. Quick return. Extra heavy. Large bearings. The smoothest running Planers.



NEW YORK, 98 Liberty St. PHILADELPHIA, 705 Arch St. PITTSBURGH, Penn Building. CHICAGO, Phenix Building.

WARNER & SWASEY,

MACHINE TOOLS CLEVELAND, OHIO.

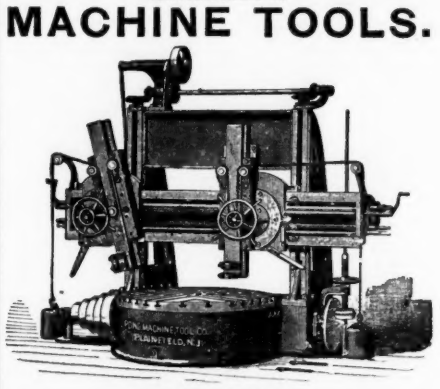
For IRON and BRASS WORK.
Illustrated Catalogue on application.

THE POND MACHINE TOOL CO.,

Formerly of Worcester, Mass.

MANUFACTURERS OF

MACHINE TOOLS.



BORING MILLS.

Radial Drills, Planers, Lathes, Heavy & Powerful, from new patterns of the latest and best designs.

SALESROOM & OFFICE, 113 Liberty St., N. Y. City.

NEW SHOPS, PLAINFIELD, N. J.

GRANES

THE YALE & TOWNE MFG CO.,
STAMFORD CONN
NEW YORK CHICAGO PHILA. BOSTON

REDUCED PRICES
OF THE IMPROVED

Jenkins Bros. Valves.

Send for 1890 Catalogue. It supersedes all previous Lists.

71 John Street, NEW YORK.
54 Dearborn Street, CHICAGO.
105 Milk Street, BOSTON.
21 North 5th Street, PHILADELPHIA.

GEO. W. FIFIELD,

MANUFACTURER OF

ENGINE LATHES

FROM 16 to 48 IN. SWING.

Cuts, Photographs and Prices furnished on application.

Lowell, Mass., U. S. A.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

J. M. ALLEN, President.
Wm. B. Franklin, Vice-President.
F. B. ALLEN, Second Vice-President.
J. B. PIERCE, Secretary & Treasurer.

THE GREAT SUCCESS

Attending the sale of our **IMPROVED MACHINE TOOLS** in the East has decided us to open a

NEW MACHINERY STORE

—AT—

64 Cortlandt St., New York,

Under the management of W. H. HARRISON, late with E. P. BULLARD.

WE WILL CARRY A FULL LINE OF NEW DESIGNS OF

IRON AND BRASS WORKING MACHINERY.

☞ **Come and see us before buying.**

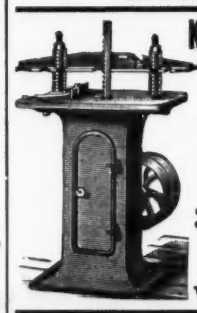
THE LODGE & DAVIS MACHINE TOOL CO.,

NEW YORK. CHICAGO. CINCINNATI.

See advertisement, page 15.

GEAR WHEELS AND GEAR CUTTING.

LEXINGTON GEAR WORKS, LEXINGTON, MASS.
BOSTON GEAR WORKS, 137 HIGH ST., BOSTON.
(GRANT) SEND FOR CATALOGUE.



Key-Seating Machines and 20 in. Drills

A SPECIALTY.

SEND FOR LIST OF

New and Second-Hand

Lathes, Planers, Drills, or anything in Machinists' Tools or Supplies.

W. P. DAVIS,
Rochester, N. Y.
Works at North Bloomfield.

GRAY'S

Grindstone Dresser.

Trues the stone without dust.
Positive. Handy. Simple.
Net Price, $12. For descriptive circular address:

THE G. A. GRAY CO.,
479 Sycamore St., Cincinnati, O.

GOULD & EBERHARDT,

NEWARK, N. J.

Eberhardt's Patent

AUTOMATIC GEAR CUTTER.

18 in. 25 in. 36 in. 50 in. 60 in. 84 in. Sizes.

"Experts pronounced it the best."

GEAR AND RACK CUTTING TO ORDER.

HEADQUARTERS IN NEW YORK CITY FOR

STANDARD

Milling Machines,

UNIVERSAL PLAIN FOR

OR

LIGHT HEAVY WORK.

All sizes ready for quick delivery.

Machines shown in operation by the man'f'rs,

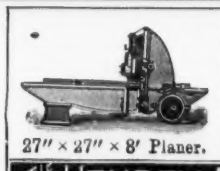
THE GARVIN MACHINE CO.,

LAIGHT & CANAL STREETS,

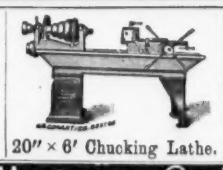
Send for Illustrated Catalogue. NEW YORK CITY.

STEEL CASTINGS.

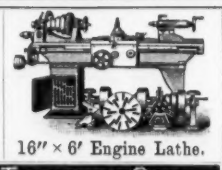
PRATT & LETCHWORTH,
PROPRIETORS
BUFFALO STEEL FOUNDRY,
BUFFALO, N. Y.



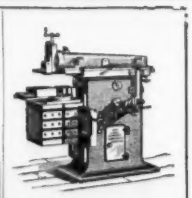
27″ × 27″ × 8′ Planer.



20″ × 6′ Chucking Lathe.



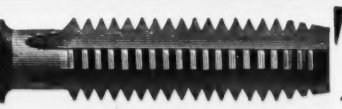
16″ × 6′ Engine Lathe.



25″ Pillar Shaper.

THE HENDEY MACHINE CO. TORRINGTON, CONN.
MANUFACTURERS OF **MACHINE TOOLS.** SEND FOR OUR CATALOGUE.

J. M. CARPENTER
PAWTUCKET, R. I.



Manufacturer —of— TAPS & DIES